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Practical Uses for HOLDEN Carburizing Baths

WRITE FOR HOLDEN CARBURIZING BULLETIN A.A. 104

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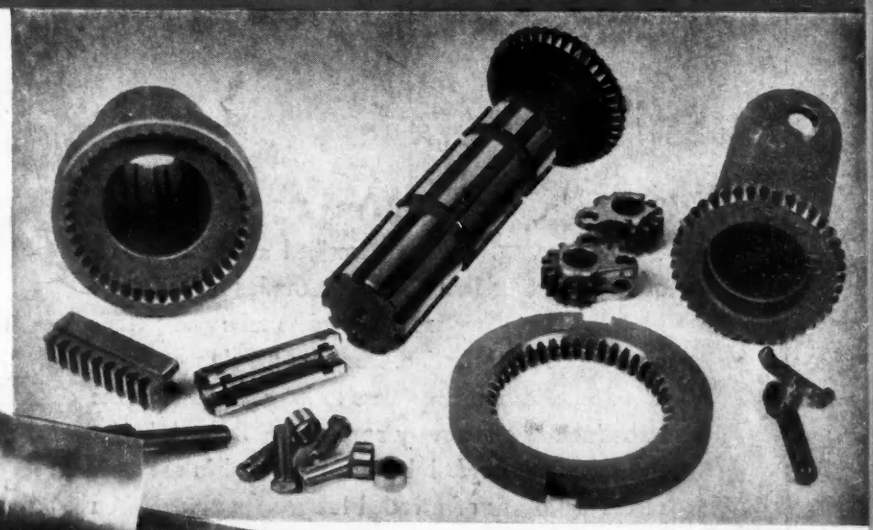

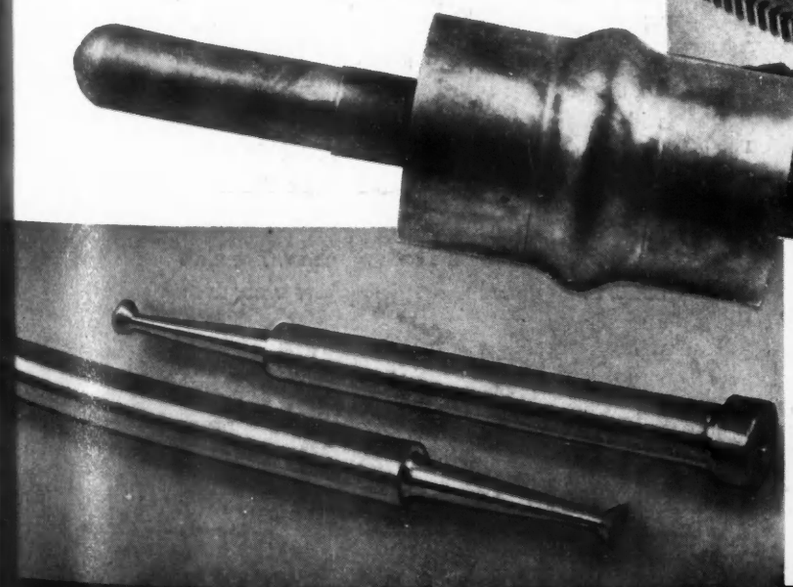

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AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

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CONTENTS

Getting the Bear by the Tail 15
Measuring Labors Productivity. *By Andrew T. Court* 17
Construction and Operation of the White Hydro Torque Transmission. *By Renke Brunken* 18
XP-81 Fighter 21
Navy's BTM Dive Bomber 21
Electro-Hydraulic Control Incorporated in Chrysler, DeSoto Transmissions 22
Expansion of Manufacturing Facilities at Nash Chassis Plant. *By Joseph Geschelin* 26
Mono-shift Mechanism Added to Mack Transmission 31
True Anti-Knock Value of a Gasoline. *By H. W. Best* 32
Wartime Developments. *By Joseph Geschelin* 35
The Bobbi Kar. *By R. Raymond Kay* 36
Spicer's New Line of Heavy Duty Transmissions 38
News of the Industry 39
Calendar of Coming Events 41
New Production Equipment 42
New Products for Aircraft 45
New Products 52
Advertisers' Index 90

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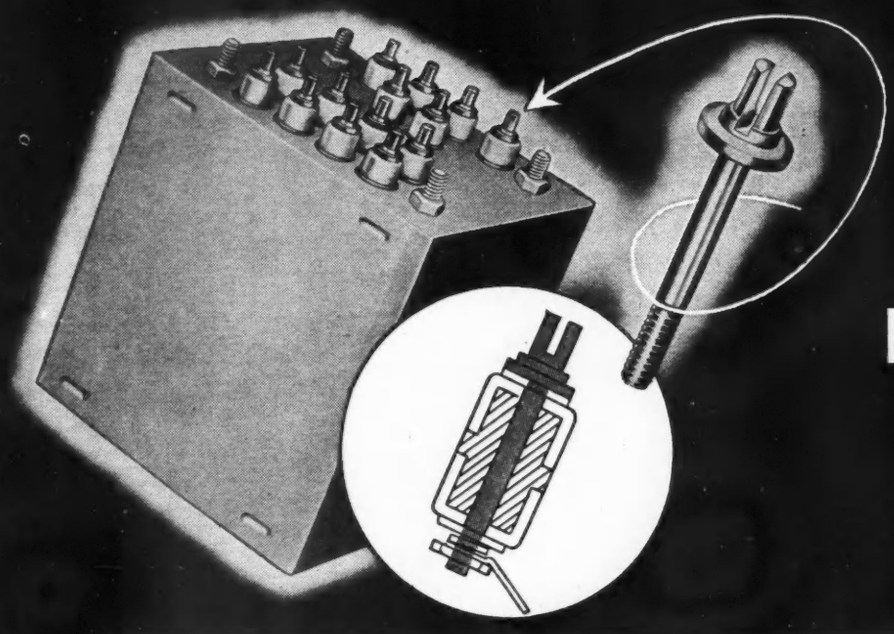

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AUTOMOTIVE and AVIATION INDUSTRIES

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March 1, 1946
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Getting the Bear by the Tail

AS LONG as the Government fixes prices, and to the extent that its price policies and wage recommendations are instrumental in fixing wages, it is, in effect, not only fixing the rate of return for the employer in each individual case but also influencing wage rates and profits in other industries, as well as security values, volumes of production, levels of employment, and the innumerable other economic conditions that result from wage and price determination. As long as the Government controls prices, it will, whether it wishes to or not, indirectly control or influence almost every major factor in the economic situation and will face the inescapable, even if unwelcome, responsibility of making policy with respect to those factors.

The primary objectives of speeding reconversion and "holding the line" on prices certainly were not made easier of attainment by the official endorsement of the view that, generally speaking, wages could be raised without necessitating price increases. This attempt to segregate wages and prices served only to encourage demands for higher wage rates and thus to promote industrial disputes and increase the upward pressure on the price level.

[And what could be said about the Government's subsequently announced slogan, "Sign-up and Trust to OPA"?—J. C.]

Many efforts have been made to establish the principle that "labor is not a commodity," with the apparent implication that wages are or should be subject to other determining influences than apply to prices in general. A considerable body of existing legislation is based on this theory. If labor is not a commodity, it certainly is a service, and the payment for it is the principal element in the costs and prices of commodities. Those costs and prices must, in a free economic system, be competitively determined; and wages, their chief constituent, cannot enjoy an exclusive immunity to competitive determination. Arbitrary or monopolistic fixation of wages is as irreconcilable with the successful operation of an economy of private enterprise as is arbitrary or monopolistic fixation of prices.

Collective bargaining has become an accepted method of wage determination. But the essence of bargaining is competition. If bargaining is to be what its names implies, the bargaining parties must be free to turn to other customers or other sources of supply if they so desire. Laws and practices tending to maintain any bargaining party in a monopolistic position must eventually result in a breakdown either of collective bargaining or of free competition.

The desire of the individual worker to obtain a larger share of the business earnings to which his efforts contribute is perfectly natural, and it is easy to understand the readiness with which many workers respond to such plausible

(*Turn to page* 70, *please*)

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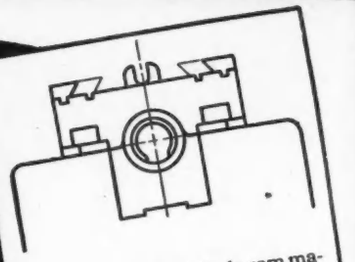
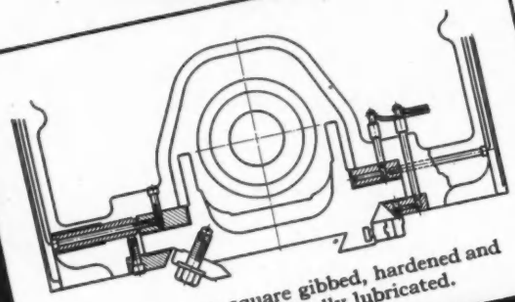
VERTICAL HYDRO-BROACH MACHINES



Receding table of single ram machines. Bearing ways are square gibbed, hardened and ground, automatically lubricated.



Ram ways are square gibbed, hardened and ground, automatically lubricated.

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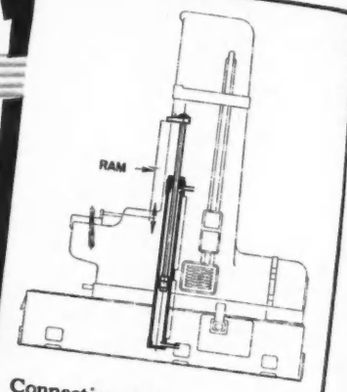
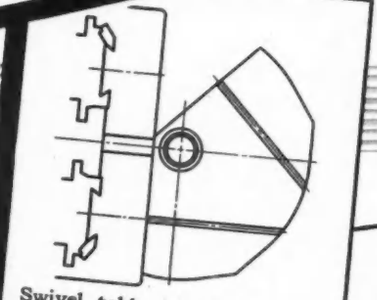
Improve Accuracy and Finish
. . . extend useful life-span



Connection between cylinder and hydraulic circuit is very short; no hydraulic vibration.

HYDRAULICALLY OPERATED LUBRICATING PUMP



Swivel table of Duplex machines. Bearing surface is hardened and ground, automatically lubricated.

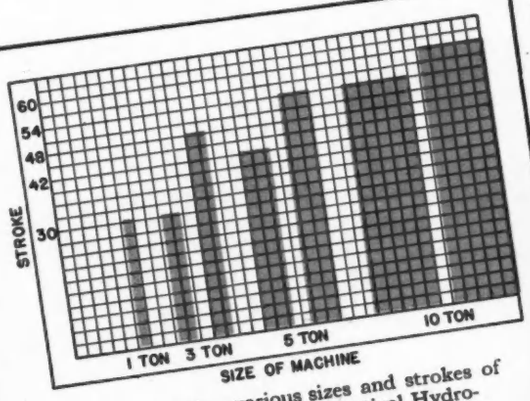
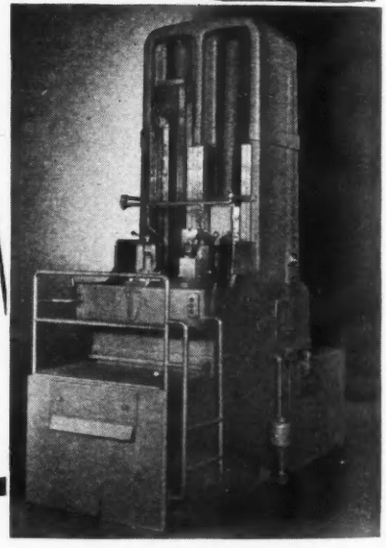
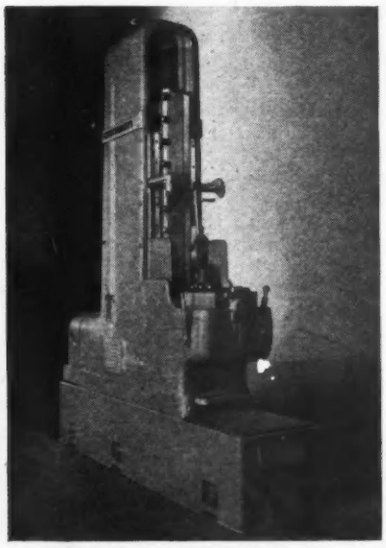


Chart showing various sizes and strokes of standard CINCINNATI Vertical Hydro-Broach Machines.



CINCINNATI Duplex Vertical Hydro-Broach. Write for Catalog M-1387.

CINCINNATI



CINCINNATI Single Ram Vertical Hydro-Broach. Write for Catalog M-1389.

Some of the features of the new CINCINNATI Vertical Hydro-Broach are shown in the sketches above. Others are: Adjustable ram ways for exceptionally accurate work. Rate valve for adjusting speed of ram to suit material being broached, and for speed of operator. Greater hydraulic oil capacity to keep system cooler. Then, at extra cost: Pre-set Cycle Control and Power Clamping for fast production. These features increase versatility, improve accuracy and finish, and extend useful life span of the machine. Complete information and specifications may be obtained by writing for Catalogs indicated under machine illustrations. Cincinnati Application Engineers will be glad to talk over your machining operations with you.

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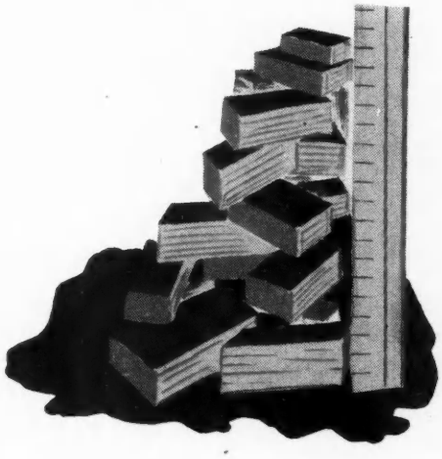


By Andrew T. Court

Labor Economist,
General Motors Corp.

INFORMATION on changes in physical output per manhour from 1941 to 1946 has become a major subject of public debate. Some observers predict a big increase in the output per manhour in the civilian durable goods industries in 1946 compared to 1941. They cite the large reductions in munitions costs during the war, that the manhours required to produce a certain plane or a gun were cut in half. They also call attention to the list of 2000 war time industrial suggestions and developments collected by the United States Department of Labor.

Others do not expect a large increase in productivity, or perhaps any increase at all, explain that the big reductions in munitions labor costs were based largely upon the application of methods long known to mass production industries, but not utilized in the munitions manufacture because before the war orders were small. The adaptation of a fully developed technology from an entirely different industrial area made it possible to show tremendous increase in output of munitions. Consequently, they say that well established and mechanized industries which were already utilizing economical mass production methods before the war cannot expect large gains in output per manhour from 1941 to 1946.

Predictions of increased productivity for the postwar period have sometimes been based on the rapid improvement experienced after the first World War. In analyzing such predictions, it is important to recognize the great influence that the introduction of new cutting materials and the installation of machine tools necessary to the full utilization of these materials have on the productivity of the metal-working industry.

High-speed steel was developed just before World War I and was tested quite thoroughly during that conflict. However, new machine tools designed to fully utilize the potentialities of high-speed steel were not built or installed to any extent until after the war, when competition again became strong. Their widespread installation in the postwar period resulted in a large increase in manhour output during the early 20's, and to a great extent accounted for the rapidity with which the nation recovered its long-time productivity trend.

A further major advance in metal-cutting technology began about 1930, with the introduction of tools tipped with tungsten carbide or similar carbide composition cutting edges. Again, these cutting edges required new, more powerful, and more rigid machine tools. Beginning about 1935, when the price of the new cutting material had dropped, many of the machine tools for the mass production industries were built primarily to take advantage of the full capacity of carbide tips. The resulting increase in the effective rate of metal cutting probably offset the restrictive practices introduced by unions by virtue of their newly-won power.

High-speed steel had not been used effectively on any large scale before the first World War, while carbide tips were used quite extensively in big volume industries before the second World War. For this reason, increases in productivity per manhour resulting from better tool tips cannot be expected to be as great in the next few years as that experienced between 1914 and the period subsequent to the first World War.

Despite the limitations of statistical measurements of productivity and the fact that any one company's productivity experience is irrelevant to the determination of its wages, inspection of specific data on the subject may be of interest. The one comprehensive figure on this important subject for the automobile industry

(*Turn to page 43, please*)

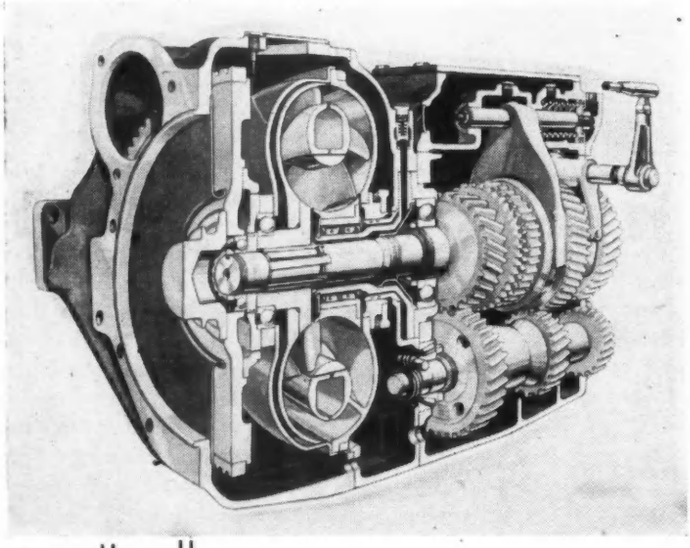
This article is a summary of a talk given by Mr. Court at a recent meeting of the National Industrial Conference Board in New York City.

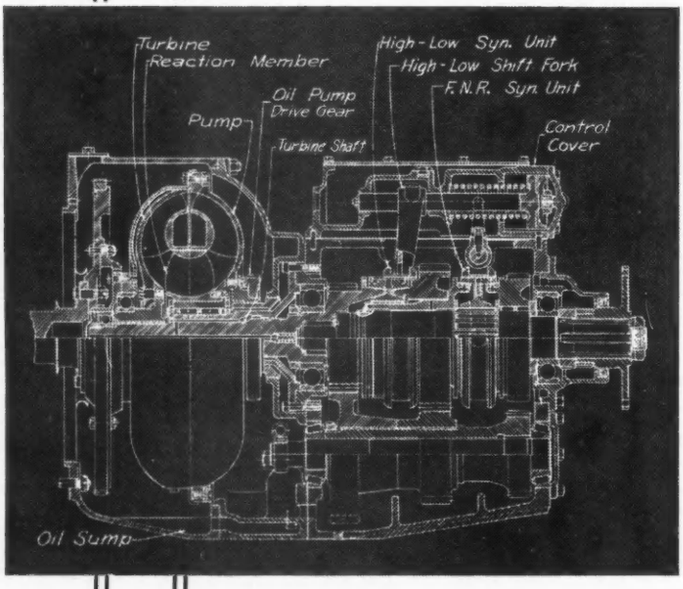
Construction and Operation of the

White Hydro

By Renke Brunken,

Transmission Engineer
White Motor Co.





THE White Hydro Torque Drive is a transmission utilizing new ideas as well as old established ones in an entirely new combination. The main elements employed are a hydraulic torque converter in combination with a hydraulic coupling newly developed by A. and H. Schneider, and a two-speed synchromesh gear box, combined with a new automatic torque responsive control system of the electric pneumatic type. The outside appearance, the size and weight are about the same as a mechanical transmission. Fig. 1 shows a cutaway view and a longitudinal section of the transmission.

The Converter

The converter is a Schneider converter. The torque converter pump, or primary side, is driven at engine speed by means of the torque converter cover and coupling gear, the latter engaging a mating coupling gear on the flywheel housing. The far end of the torque converter pump is equipped with an extension which serves as an oil seal and to which is attached a gear which mates with a driven gear on an oil pump. The oil pump keeps the converter filled with oil, circulates the oil through a cooling system and from there back to the converter. The oil pump (see Fig. 2) consists of two separate pumps — a pressure pump, the suction side of which is connected to an oil tank and the pressure side to the torque converter proper; and a scavenging pump, the suction side of which is connected to the oil sump of the converter housing and the pressure side to the oil tank. The adoption of this system made it possible to substitute standard piston rings for intricate oil seals in the hydraulic unit. These piston ring oil seals are not intended to be 100 per cent oil-tight, since any oil leaking through will be caught in the oil sump and returned to the system. By driving the oil pump at engine speed, oil pressure will always be available whenever the engine is running. The operating pressure is about 40 psi.

This article was prepared from the paper, "The White Hydro Torque Drive," which was presented by Mr. Brunken at the 1946 SAE Annual Meeting.

Fig. 1—Cutaway view and longitudinal section of the White hydro torque drive transmission.

Torque Transmission

The converter turbine, or secondary side, is mounted opposite the converter pump and is attached to the turbine shaft through a hub. The rear end of this turbine shaft is mounted in a ball bearing which in turn, through its cages, is secured to the transmission housing. This bearing takes the hydraulic thrust as well as the thrust induced by the gears. The forward end of the turbine shaft is mounted in a pilot ball bearing which, through the coupling gear, is piloted in the flywheel itself. The forward end of the coupling gear contains a closure which seals the hydraulic unit on the forward end.

The reaction member is located between, and concentric to, the pump and turbine. The inside of the reaction member is provided with a hardened sleeve which serves as the outer race of the freewheel unit. The inside diameter of the freewheel unit is supported by a reaction member sleeve which in turn is bolted to the transmission case. The reaction member is held concentric to the reaction member sleeve by two plain roller bearings adjacent to the sprag assemblies of the freewheel unit. The longitudinal position of the reaction member is fixed through two thrust washers held in position by means of a shoulder and a snap ring.

The oil from the pressure oil pump enters the torque converter housing between the reaction member sleeve flange and the extension of the torque converter housing from where it flows through a spline in the reaction member sleeve into the space between the converter pump and the reaction member and from there into the converter proper. The oil outlet from the converter is in the space between the reaction member and the turbine hub, from there through the space formed between the outside of the turbine shaft and the inside of the reaction member sleeve into the space formed between the reaction member sleeve flange and an oil baffle, into a radial hole of the reaction member sleeve and from there into the torque converter housing through the oil pressure relief valve and to the suction side of the scavenging pump. However, part of the oil will be diverted through an axial hole in the turbine shaft into the main shaft of the transmission, where it will serve as a lubricant for the gears and bearings.

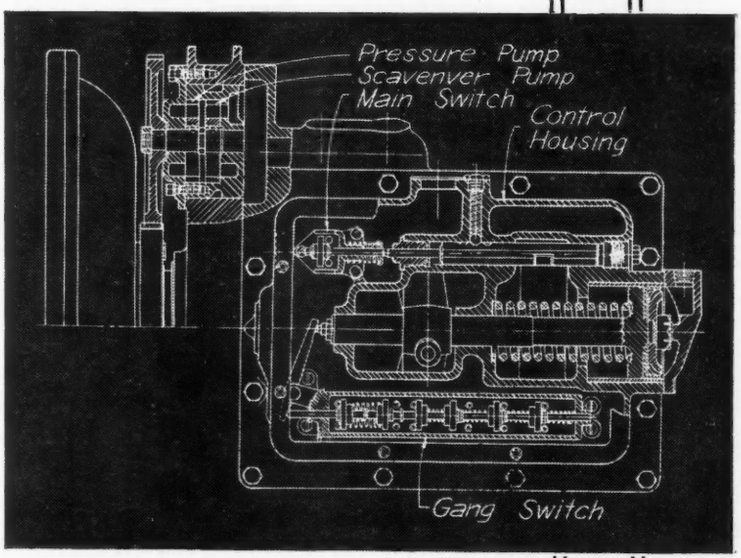


Fig. 2—Cover control unit for operation of the high-low synchromesh collar. The pressure and scavenging pumps are shown in the upper left of the drawing.

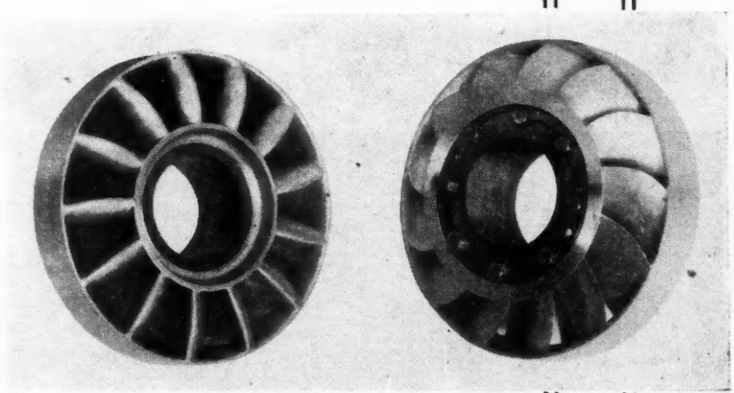


Fig. 3—Reaction member wheel of the White transmission.

The converter wheels are single-piece aluminum castings and extremely rigid. The vanes are cast integral to close limits. A detailed view of the reaction member

wheel is shown in Fig. 3.

The gear box is fundamentally a two-speed synchromesh transmission with a reverse gear train. The ratio is about two to one. Two synchromesh units are employed. The first is used in the forward, neutral, and reverse positions, and the unit is actuated manually by means of the direction selector. The second synchromesh unit of the blocker type is employed in the high-low position, and is power operated. The low speed main shaft gear is mounted rotatively on a sleeve, and the rear end of this sleeve is machined for engagement with the forward, neutral and reverse synchromesh unit. Therefore, it is possible to leave the unit engaged in forward gear, irrespective of the position of the high-low shift collar. This results in a simplification of the control system, as well as making it possible to have the turbine shaft always solidly connected to the output end of the transmission.

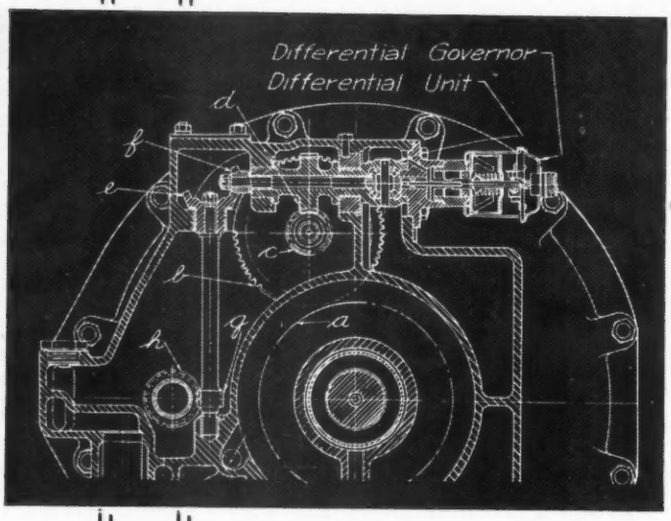


Fig. 4—Sectional view of the differential unit and differential governor.

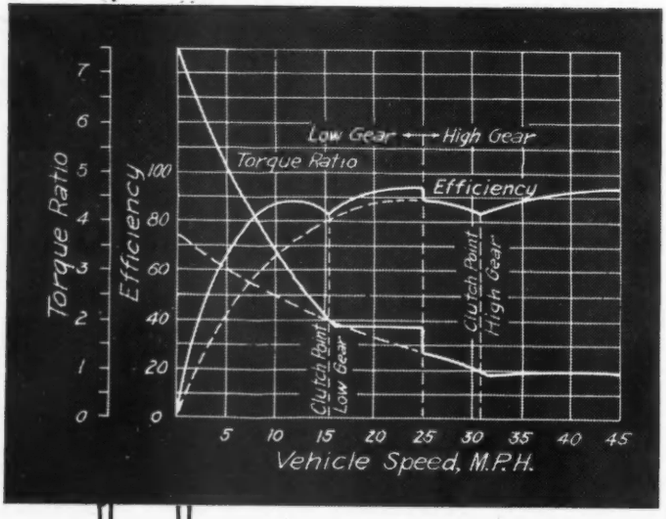


Fig. 5—Torque-efficiency curves for the hydro torque drive using the two-speed gear box, compared to the curves of conventional converter-coupling unit.

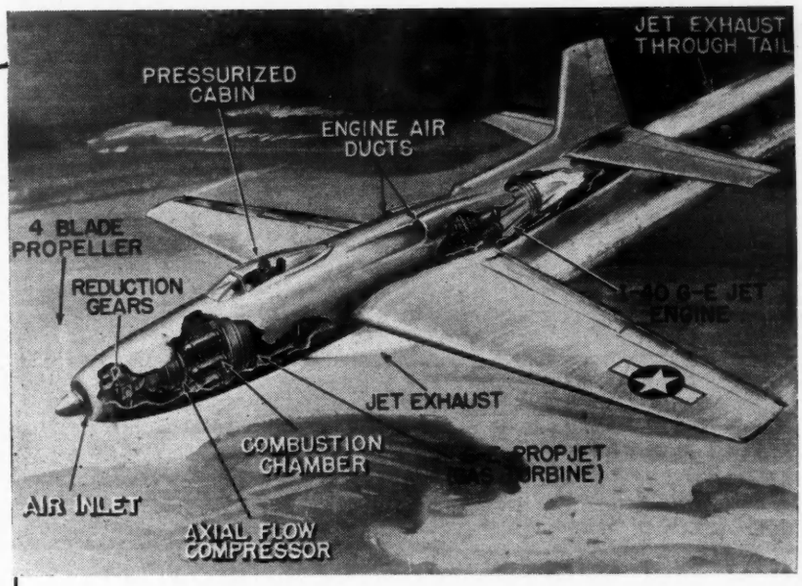
The control cover shown in Fig. 2 is mounted on the transmission cage and is designed to effect power operation of the high-low synchromesh collar. Provision is made for the necessary control switches, which are the main switch and the gang switch. The power utilized to shift the transmission is air pressure applied to a shift piston. The piston is machined integral with the piston shaft, to which is attached the high-low shift fork which engages the high-low shift collar. The piston is moved into the high position by means of air pressure and returned to the low position by means of spring pressure. This means, that in case of failure of air pressure, the spring will return the transmission to low gear, enabling the vehicle to proceed at lower speeds. Another advantage is derived from this arrangement. In case of battery failure, the vehicle may be started by pushing in low gear since the turbine shaft is turning at relatively high speeds and transmitting sufficient power to the pump to start the engine. The main switch connects the automatic controls for forward movement and disconnects the automatic controls for neutral and reverse position. The gang switch is incorporated to time the shift cycle correctly in relation to the position of the high-low shift fork, and is operated through a switch lever which contacts the switch shaft on one end and the piston shaft on the other.

Automatic control can be incorporated in a transmission by taking advantage of the fundamental characteristics of the converter, namely that for any given speed ratio the torque ratio is always the same. Therefore, the speed ratio is an indication of the torque requirements. The speed ratio is the quotient of the turbine speed divided by the pump speed. By substituting speed difference for speed ratio, a measure of the torque requirements can be had by utilizing a differential unit to measure this speed difference. A differential unit has three shafts, and by driving one shaft at engine speed, the second shaft at turbine speed, the third shaft then turns at a rate of speed which is proportional to the speed difference between the engine speed and the turbine speed.

The differential unit and the differential governor are shown in Fig. 4. The differential cage is driven in proportion to the engine speed through gear trains a-b and c-d. The lower differential pinion is driven in proportion to turbine speed by means of gear trains e-f and g-h.

(*Turn to page* 46, *please*)

XP-81 Fighter

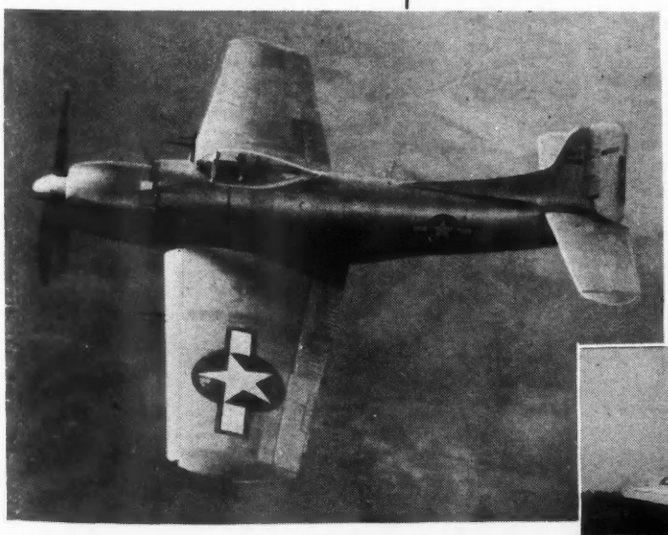


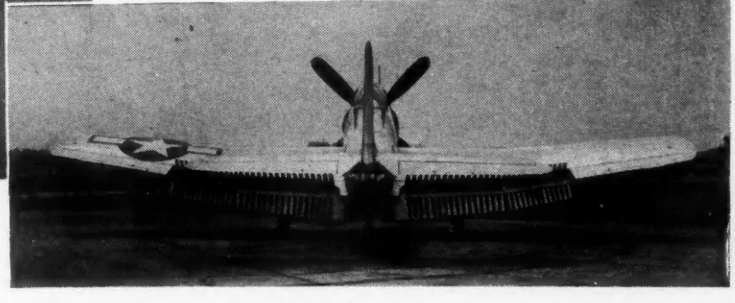
THE Army's XP-81 fighter, designed and built by Consolidated Vultee, is powered by the General Electric TG-100 project (illustrated in the Nov. 15, 1945, issue, page 28, of AUTOMOTIVE AND AVIATION INDUSTRIES), mounted in the nose and driving a four-bladed propeller of 12 ft diameter, and by a G-E I-40 jet propulsion unit (see page 36, Jan. 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES), located near the rear of the fuselage. The length of the new fighter is 44.67 in., its wing span is 50.5 ft, wing area 425 sq ft, height 13.5 ft, and gross weight 19,500 lb. Performance data for the XP-81 are still secret.

Navy's BTM Dive Bomber

THE Martin Mauler, designated the BTM, is the Navy's newest dive-torpedo bomber. It is a long range multipurpose plane designed for operation off the new large aircraft carriers of the Midway class. The wings are of box-type construction, with outer wing panels folding vertically for carrier accommodation. The Mauler has no internal bomb-bay. Bombs, rockets, and torpedo are suspended externally in shackles under the center section and wings. An unusual feature is its intermeshing finger-type dive brakes (see illustration) which open in less than five seconds. As a dive bomber the plane can carry 4000 lb of bombs or rockets. As a torpedo bomber, it carries one torpedo with additional bombs or rockets. It mounts four 20 mm cannon. Other data follow:

Engine—Pratt and Whitney Wasp Major with a military rating of 3000 hp; Propeller—Curtiss Electric, four bladed of 14 ft, 8 in. diam; Speed—Over 350 mph (level flight); Range—over 1700 miles; Weight—19,500 lb gross; Wing span—50 ft; Length—41 ft, 8 in.





(Above) Navy BTM Mauler built by Glenn L. Martin Co.
(Right) Rear view showing finger-type dive brakes in open position.

The 1946 De Soto Custom four-door sedan

Electro-

in

THE 1946 Chrysler, De Soto and Plymouth cars are offered with a variety of mechanical and styling changes which are summarized in this article. Those in the new Dodge models are scheduled for announcement about the middle of March.

A major Chrysler and De Soto engineering innovation is a new transmission with built-in hydraulic and electrical control that is available as optional equipment. For use with fluid drive, this hydraulically-operated transmission replaces the Vacamatic transmission which was offered in 1942. It has four forward speeds, as before, and contains two driving ranges—third and fourth, and first and second, the low range being intended only for unusual traffic or terrain conditions since most driving can be done in the high range. In any event, the manual shift gives the selection of the driving range as well as reverse, while the automatic hydraulic shift makes the change down or up within the range.

Although an assembly drawing of the gear box is not available at this writing, the operation of the unit may be readily visualized by referring to Fig. 1, which shows the main shaft train in relation to the shifting fork and actuating piston immediately above it in the photograph. This same view is carried out in the diagrams illustrating the functioning of the control elements. Power for actuating the cylinder is supplied by a rotor type fluid pump installed in the rear end of the gear box.

An important feature is the compulsory kick-down switch which permits the driver to force a down shaft in any range, overruling the governor, whenever an emergency acceleration is desired. The controls are mounted directly on the gear case as shown in Fig. 2. The solenoid is the first unit at the left, adjacent to it is the governor, while the interrupter may be seen directly above the governor. The left side of the transmission carries the manual shift linkage.

The operation of the control system under the various operating conditions is as follows. When the ignition is off all electrical and hydraulic circuits are inactive. The relay points are open, governor points are closed, solenoid is inactive, and pilot valve is held in up position. At this stage the main valve is down, closing off the oil pressure line, the piston is in the back position, and the synchro-sleeve is disengaged.

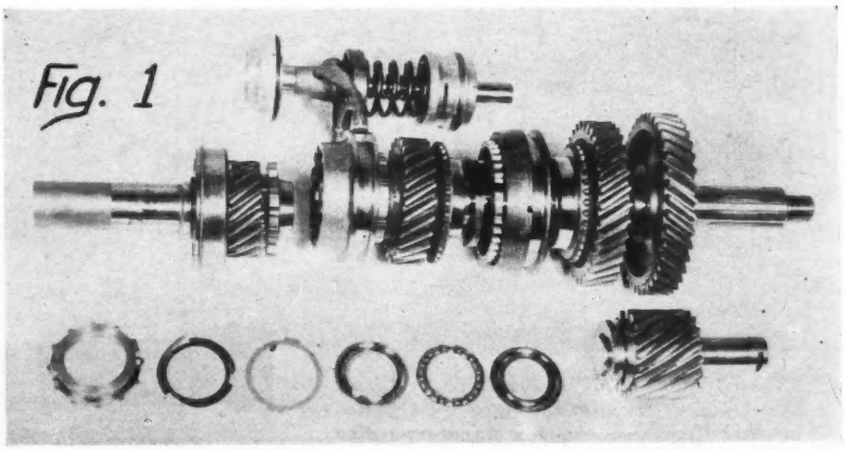
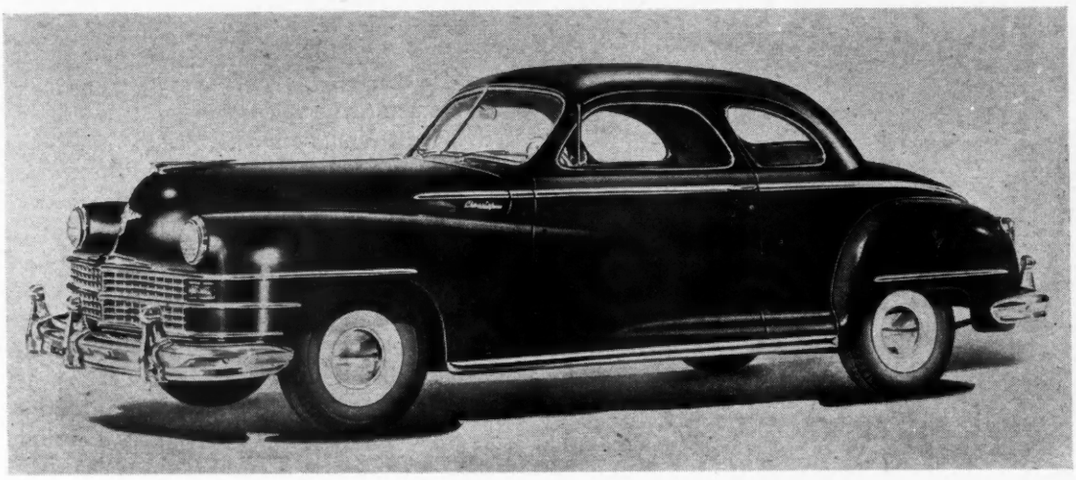


Fig. 1—Main shaft assembly in Chrysler hydraulically operated transmission, showing the actuating piston and rail at the top, with the shifting fork for engaging the synchrosleeve.



Chrysler Royal six-passenger club coupe.

Hydraulic Control Incorporated Chrysler, DeSoto Transmissions

Mechanical and Styling Changes Announced for 1946 Chrysler, De Soto and Plymouth Models

When the car is at a standstill but with the ignition on and the engine either running or stopped (see Fig. 3), the ignition switch, governor, and solenoid circuits are active electrically. Grounding of the circuit at the governor, with the ignition switch on, activates the coil in the relay and closes the relay points, thus permitting current to flow to and energize the solenoid. This forces the plunger down and closes the pilot valve but the main valve remains in the down position since there is no oil pressure and the guide rail assembly remains in the back position with the synchro-sleeve disengaged.

The next step is to consider the car in motion (see Fig. 4) and accelerating above governed speed, before easing upon the accelerator pedal for a shift. This may be true in either the high or low range. At this stage the hydraulic and electric circuits again are completely inactive because the governor points open as speed reaches approximately 6 mph in first and 11 mph in third, breaking the ground and de-energizing the electrical circuit. Since the solenoid is thus de-energized the spring pressure pushes the pilot valve to the up or open position, permitting the flow of oil to lift the main valve and enter the cylinder where it pushes the piston forward, ready for the shift. The

1946 Plymouth five-passenger club coupe.

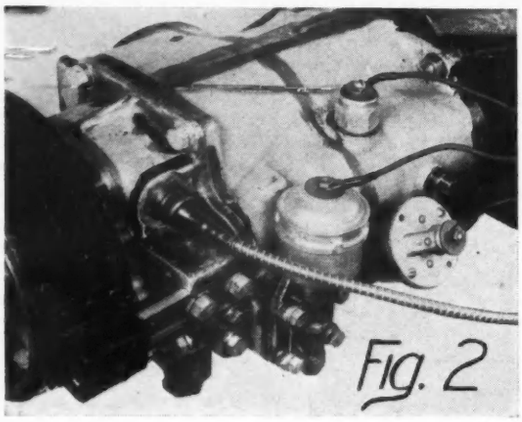


Fig. 2

synchro-sleeve remains disengaged during this interval.

When engine and car speed have been synchronized by momentarily releasing the accelerator pedal the electrical circuit remains inactive as in Fig. 4 but the engaging spring of the cylinder is permitted to extend and complete the movement of the rail and synchro-sleeve into engagement. This is an automatic shift from first to second or third to fourth, depending upon the range established by the manual control.

The events involved in shifting downward under governor control—returning to third or first as the case may be, are described as follows: As the car speed falls below the governor setting, mentioned earlier, the governor points close, the circuit is grounded and re-establishes the flow of current activating the relay coil. This closes the relay points, energizing the solenoid which then pushes down the pilot valve to block off the hydraulic circuit and open the drain ports to the case. As the oil pressure is released, the piston is moved to its back position by the return spring. At this point the piston, in sweeping across the contact ball of the interrupter, compresses it flush with the cylinder wall. This causes a shorting of the circuit to the distributor because of the ground established at the interrupter switch, resulting in

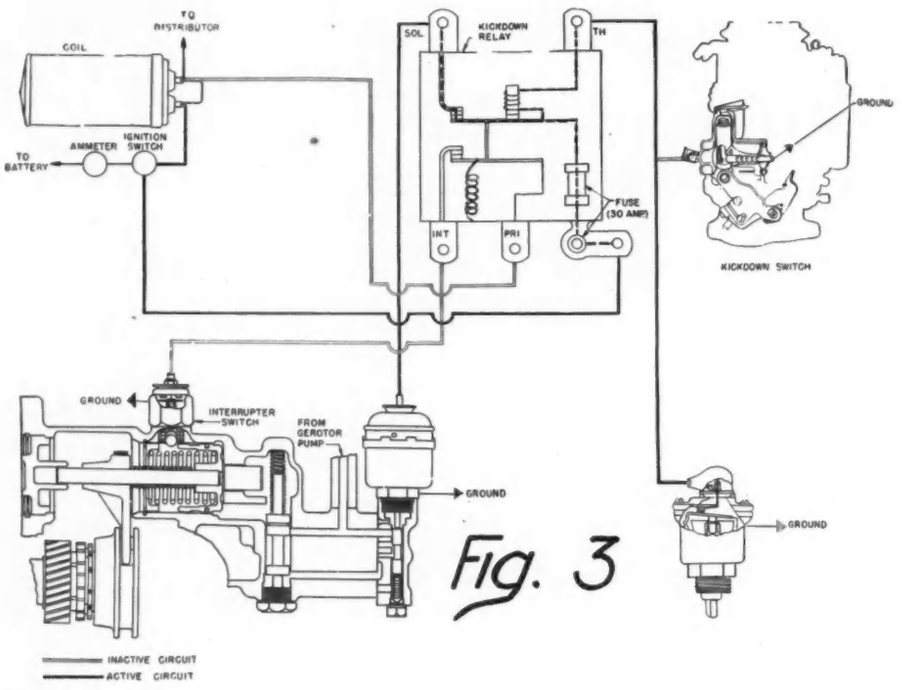


Fig. 3

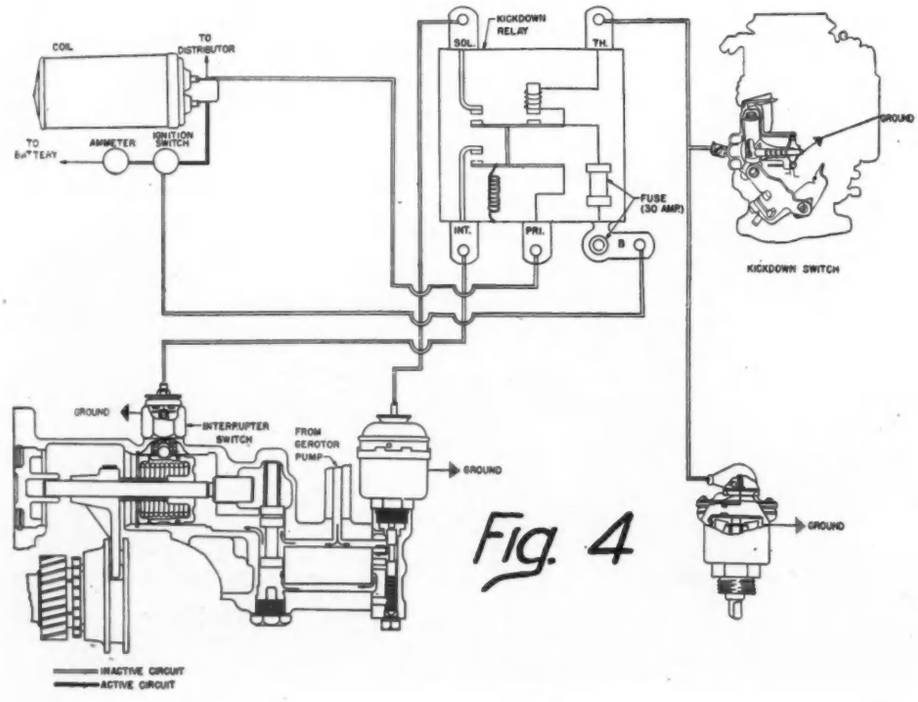


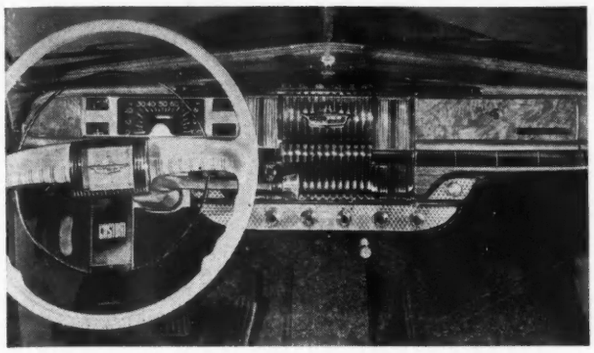
Fig. 4

Fig. 2—Right side of the transmission showing the solenoid in the rear corner, the governor near the center, and the interruptor switch directly above the governor.

Fig. 3—Schematic drawing of transmission control system conditions with ignition on and car at standstill (engine running or not running).

Fig. 4—Schematic drawing showing conditions existing in the control system when the vehicle is in motion and accelerating in low gear above governed speed, just before the accelerator is eased.

Fig. 5—Conditions in the control system when the vehicle is in third or first gear and running below governor speed.



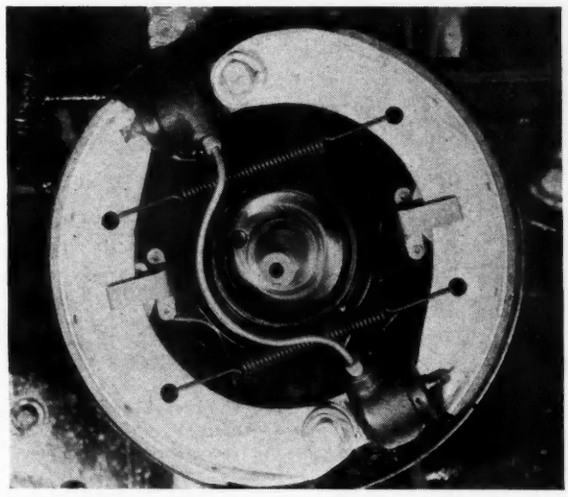
De Soto instrument panel.

a momentary interruption of engine ignition, thereby permitting toque reversal which enables the return spring to withdraw the synchro-sleeve. The completion of this maneuver, Fig. 5, pictures the synchro-sleeve disengaged and moved to its back position but with the electrical circuits active since the governor points are closed and the circuit grounded.

The next major phase is what happens when the driver uses the kick-down switch to over-rule the governor so as to force an emergency downward shift. This has the same effect upon the entire circuit as the shift down under governor control with the exception that the grounding of the electrical circuit is done through the kick-down switch at the driver's election, instead of the governor ground since in this case the governor points are open owing to a vehicle speed above the governed speed.

Completion of the kick-down maneuver leaves the situation precisely as it was shown in Fig. 4, the piston being back in position with springs compressed and ready to engage the synchro-sleeve when the accelerator pressure is eased to prevent down shift at high car speed when change in gears is ineffective and might be hazardous. However, since the vehicle speed still is above governed speed, the governor points remain open and, consequently, the electrical circuit remains inactive. The solenoid being de-energized in this situation, the pilot valve remains open, leaving the oil pressure circuit active so that the piston has moved forward in readiness to engage the synchro-sleeve.

The important feature at this point, however, is that in over-ruling the governor some form of safety device must be interposed to prevent down shift at high car speed when change in gears is ineffective and might be hazardous. This is accomplished by the installation of an upper limit switch in the kick-down switch assembly. When speeds above 45 mph are reached, the spacer point is automatically raised to prevent further use of the kick-down device.



Two-cylinder front brake design on Chrysler cars.

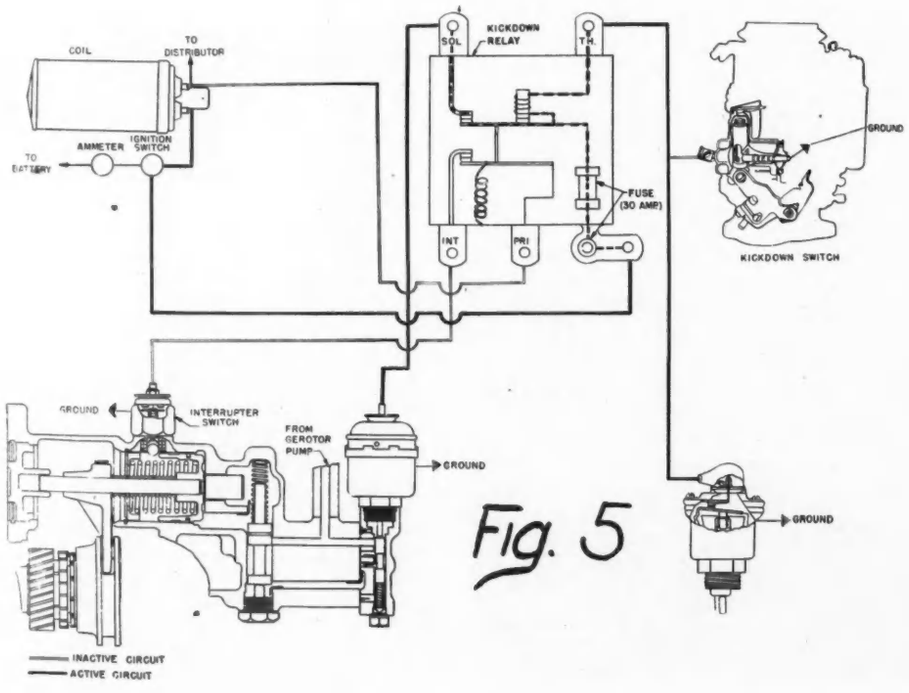
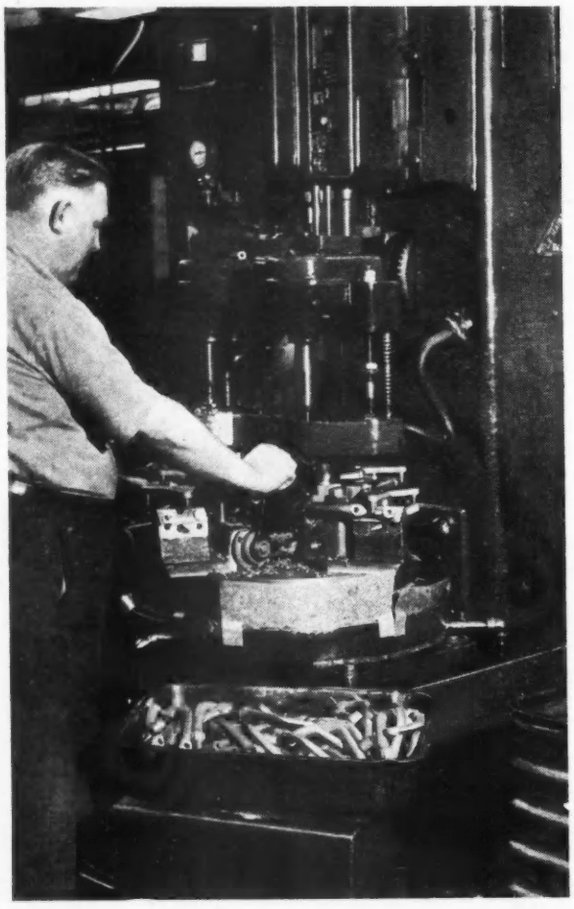


Fig. 5

The transmission incorporates a non-locking design and larger gears with a change in gear ratios to improve acceleration, the ratios being reduced to—First speed, 3.57 to 1; second, 2.04 to 1; third, 1.75 to 1; and fourth, 1 to 1.

Although the engines remain the same in basic specifications, a number of

(*Turn to page* 66, *please*)



LeMaire, 4-station special machine, drilling and rough- and finish-reaming the tapered hole in the steering arm.

Expansion

By Joseph Geschelin

The Feb. 1, 1941, issue of AUTOMOTIVE AND AVIATION INDUSTRIES contains a rather extensive article recording the modernization of the Nash plants in Kenosha and Milwaukee incident to the introduction of the then new Nash 600. At that time Nash-Kelvinator Corp. had invested around $7 million in the creation of the new manufacturing facilities. The war soon halted the operation of the plant and ushered a period of conversion to war production, removing most traces of passenger car manufacturing facilities at Kenosha with the possible exception of the engine building.

The postwar reconversion program is quite interesting. In the main, it was feasible to recreate the facilities which existed when production was halted by the war, particularly since the setup was entirely new and relatively unused. In addition, however, the management had allotted the sum of some $4.5 million for expansion, rearrangement, and new equipment designed to lift Nash to a higher level of activity capable of meeting the announced sales objective. Some of the program already is in effect; some of it is in progress and should be completed shortly. Apart from a modernization of equipment it was felt desirable to centralize and make self-contained each of the major manufacturing departments in the interest of time saving, reduction in handling, but above all to make finished assemblies readily accessible to the final assembly line. This sort of planning is found in the rear axle and transmission departments.

IN KENOSHA, WIS., the Nash Motors Division of Nash-Kelvinator Corp. has a centralized operation producing its own stampings, castings, and forgings. It builds its own engines, transmissions, axles, and suspensions while the Seaman Body Division in Milwaukee produces the bodies for the entire line. In effect, these activities place Nash in the enviable position of having complete control of the manufacturing problem with the exception of electrical equipment and accessories.

In the case of the rear axle,

Block test department—engines come in on the floor conveyor on cradles which are readily wheeled to the stands. The line in the center shows clearly the method of attaching engine cradles to the conveyor by the use of the two heavy pins—one in front, the other in the rear of the cradle.

# of Manufacturing Facilities

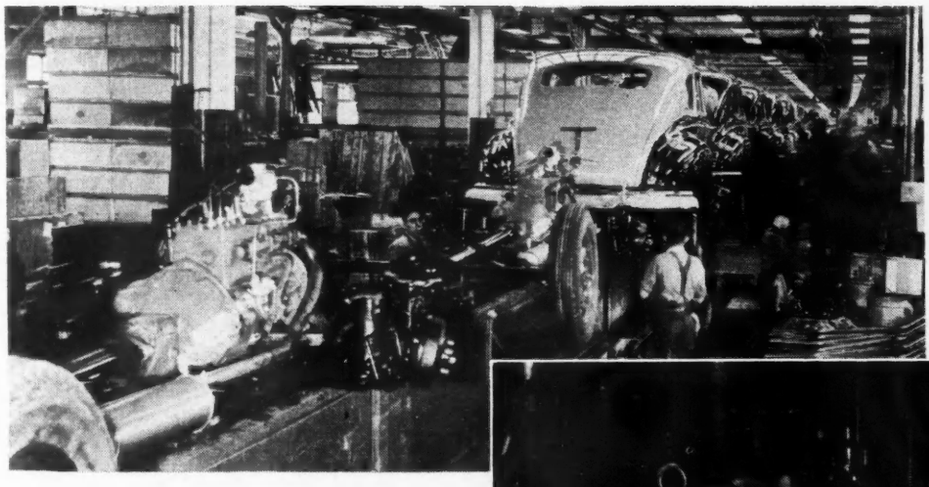
Continues at Nash Chassis Plant

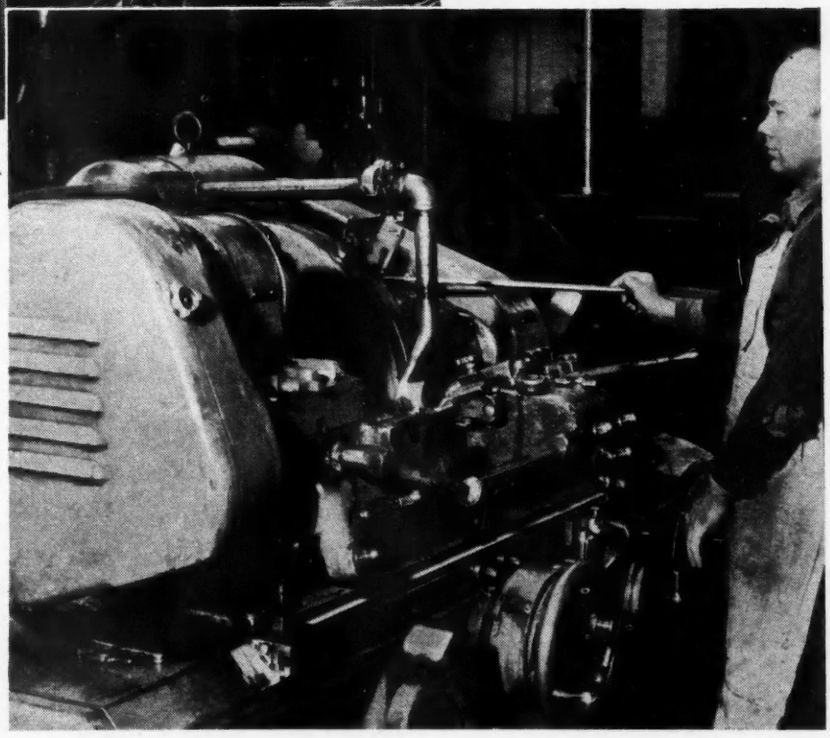
the equipment formerly in the press shop area was moved into a new section adjacent to the final assembly line and laid out for smooth straight line flow within the department. Previously, all heat treating operations were centralized in the main heat treating department, thus making it necessary to transport gears and shafts and other parts for axles to the central heat treating department. Under the new set-up a new radiant tube Surface Combustion deep case gas carburizing furnace is being installed in the rear axle department, making it completely self-contained and self-sufficient.

This is the 115th in the series of monthly production features

The same was done in the case of the transmission department, although this activity required more of an expansion program. It will be recalled that before the war Nash built its own transmission for the Ambassador line but bought the one for the Nash 600. When planning for reconversion it was decided to build the "600" transmission as well. As in the case of the axle, all heat treating equipment required for transmissions has been taken out of the main heat treating department and installed in the transmission building.

By moving the rear axle machine shop out





(Above) View of the initial stages on the "600" final assembly line. In the foreground may be seen the last stage of the chassis assembly over which the body is dropped.

(Right) Close-up of Norton external grinder used for grinding the large diameter and facing shoulder on the steering knuckle pin.

of the press shop area, the plant engineers made available considerable floor space into which the press shop could be expanded. This is under way and will be completed just as soon as certain new press equipment becomes available.

One of the major aspects of the reconversion plan—and now in operation, is a sizable addition to the new engine building, comprising some 50,000 sq ft of area. This houses the final motor block test department, a conveyorized line for the installation of accessories, equipment for the storage, circulation and filtering of lubricating oil for the test stands, and a large area for the storage of engines prior to delivery for the final assembly line.

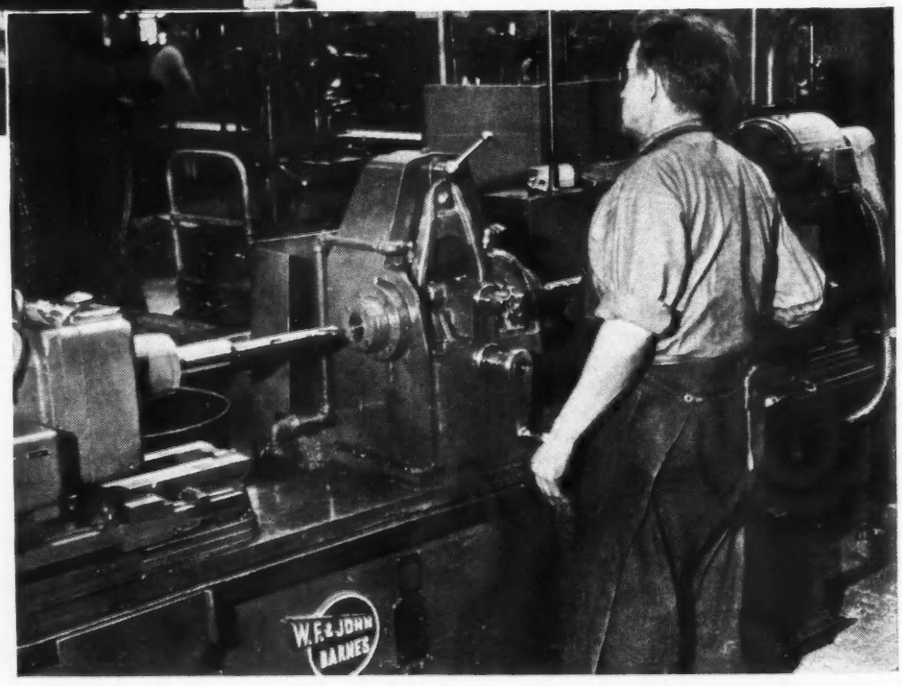
It is pertinent now to comment on a phase of manufacturing activity which is entirely new and did not exist before the war. When Nash announced its 1946 models, it was pointed out that the front end suspension on the "600" was new. Actually it represents a marked advance over the previous design in many respects. This article is concerned primarily with the production of the new suspension, the techniques for making the individual parts, and the method employed for their integration, with the major part of this article devoted to the manufacture of selected parts of this assembly.

Before touching upon the details for the suspension department, the mechanization of this plant—its conveyors and materials handling system—is of interest. Many of the machine lines are served by the familiar gravity roller conveyors. Inclined gravity roller conveyor sections are employed for the transfer of engines to the assembly line where they are picked up by means of a Cleveland Tramrail and an electric hoist for installation in the chassis. In addition to the hoists and conveyor lines, much of the interdepartmental hauling as well as other materials handling tasks are facilitated by

Factory Routing Steering Knuckle

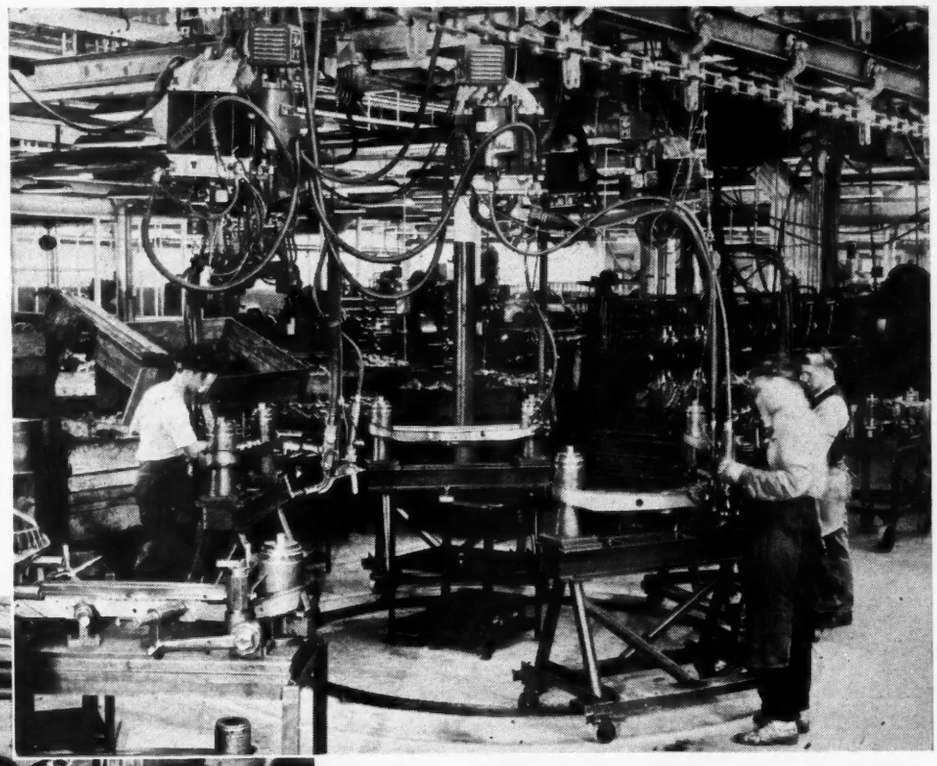
OPERATION AND EQUIPMENT

Center both ends—**Hendy double end centering machine.**
Rough turn stem—**LeBlond lathe.**
Rough and finish turn stem—**Fay lathe.**
Recenter—**Henry & Wright drill press.**
Rough grind bearing diameters—**Landis grinder.**
Rough and finish face both sides of flange—**Fay automatic lathe.**
Drill, ream and burr flange holes—**No. 914 Barnes drill.**
Thread stem end—**Landis threader.**
Mill 3/16 in. keyway—**U. S. hand mill.**
Drill cotter pin hole—**Kingsbury drill.**
Recenter—**Drill press.**
Grind taper between bearings—**Norton grinder.**
Grind seal diameter—**Landis external grinder.**
Finish grind bearing diameters—**Landis grinder.**

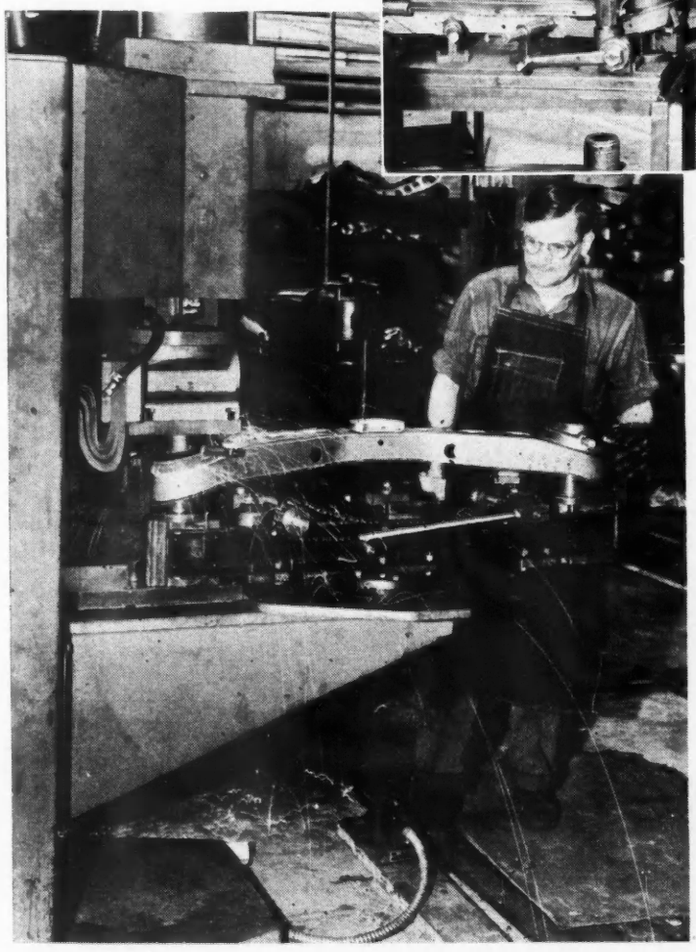


(Above) Sundstrand automatic lathe set up for turning the small diameter on the steering knuckle pin.

(Right) W. F. & John Barnes double-end horizontal machine designed for the rough- and finish-reaming of two holes in the upper control arm.



(Below) Initial subassembly of the front suspension member, principally the projection welding of the "tower" to each end. The several pieces comprising the subassembly are installed in the welding fixture, then each end is presented under the welding head. The machine is an Acro projection welder, fitted with a pivoted fixture as shown.



(Above) This is a view of the merry-go-round welding conveyor in the front suspension welding department. The portable Progressive welding guns and welder transformers may be seen overhead.

there are features of interest in the machine shop and welding department. The suspension assembly is integrated almost entirely from stampings which are later welded as subassemblies and finally made up by welding into a light but structurally rigid unit. Apart from fastenings, the only exception is the use of forgings for the steering knuckle pins, the steering arms, and steering knuckles. Altogether the front member assembly is comprised of 27 individual stampings.

Welding operations include resistance welding—spot and projection techniques—on various types of welding machines; and electric arc welding for the finishing operations in a series of enclosed booths, using the familiar Lincoln shielded arc equipment.

Instead of covering the process in complete

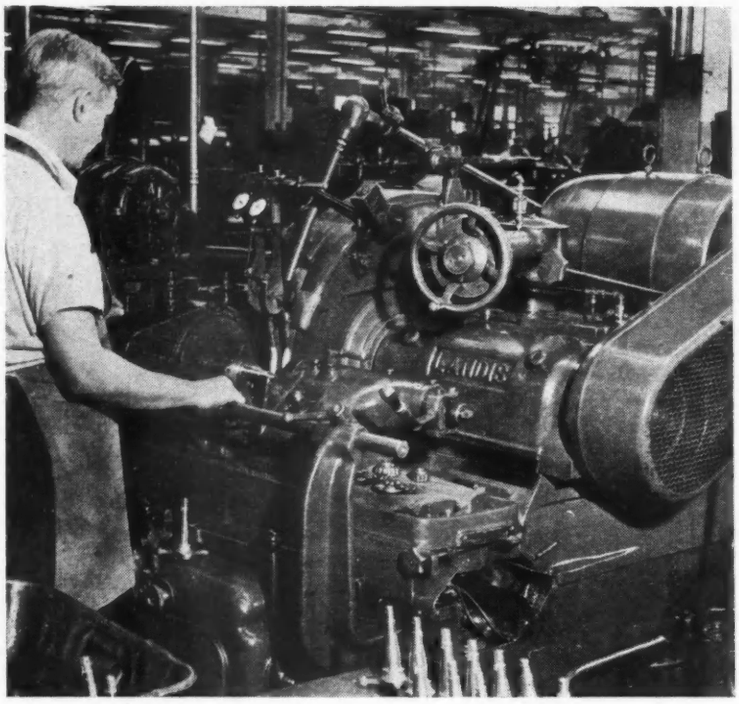
a fleet of Elwell-Parker and Clark Trucktractor industrial trucks of various types. Altogether the Kenosha plant boasts 72 different conveyor lines without taking into account the equipment in the foundry. Including the 13 body storage conveyors, each 556 ft in length, the floor assembly conveyor lines total well over two miles in length. The eight monorail systems have a length of over 2½ miles.

Since the "600" suspension system is entirely new,

Factory Routing Steering Knuckle Pin

OPERATION AND EQUIPMENT

Drill, ream and spotface 4 holes—**No. 914 Barnes drill.**
Center both ends—**Sundstrand double end centering machine.**
Turn and face short end—**Fay lathe.**
Turn small diameter end—**Sundstrand lathe.**
Thread—**Landis threader.**
Drill (2) No. 29 holes—**Kingsbury drill.**
Grind large diameter and face shoulder—**Norton external grinder.**
Grind small diameter—**Cincinnati external grinder.**
Mill gage surfaces—**Cincinnati automatic mill.**



Close-up of Landis grinder for the rough grinding of bearing diameters on the steering knuckle.

detail, a sampling of activity will be given by describing a number of individual parts. Here, for example, is the front suspension upper spring seat, a stamping to which are spot-welded four small steel blocks which are drilled and tapped later. This part is then assembled in to the "tower" member which is made up in rights and lefts and serves as the housing for the coil spring and direct acting shock absorber. The spring seat is first pressed-in on a Logan air press, then welded in a fixture on an Acro spot welder—first at the top face in one setting, then at the flange in the second setting. This is followed by some detail machine operations of drilling, tapping, and chamfering.

At this point the small sub-assemblies have been prepared and the assembly of the box type cross member begins. First major sub-assembly is the welding of the "tower," mentioned above, to the right and left hand ends of the front suspension lower cross member (box frame). This is done in a large Acro projection welder, fitted with a heavy fixture to take the frame member. The fixture is pivoted at the center so as to present each end of the member, one end at a time, to the welding head. For this operation the two tower sub-assemblies are assembled in place, fitted with the electrodes, then projection welded around the flanges. Just prior to welding in this machine a reinforcement stamping is welded into the member on an Acro spot welder.

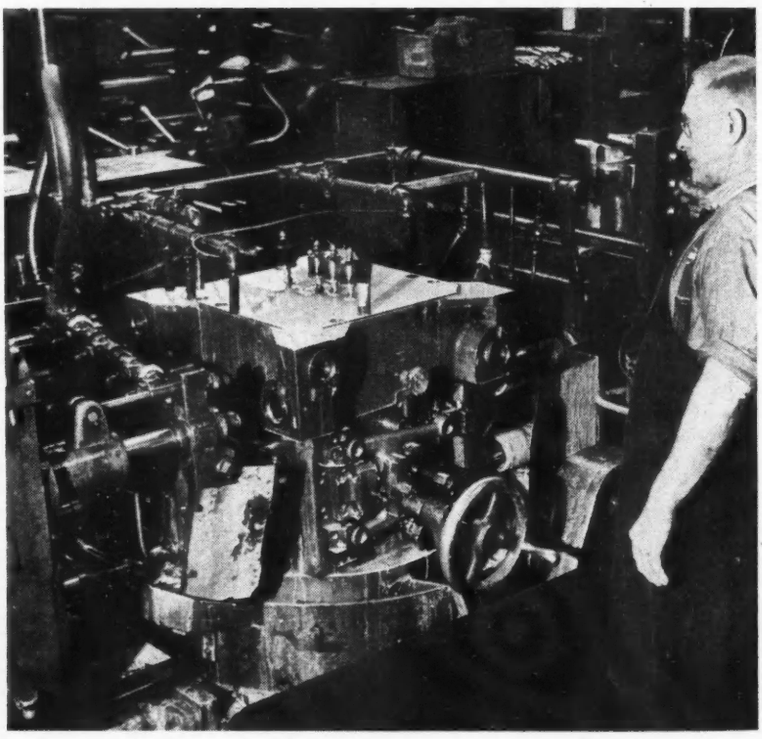
The front member is now ready for final assembly by resistance and arc welding. The resistance welding is done in fixtures mounted on a merry-go-round conveyor served by a battery of Progressive welding guns and controls, the transformers being suspended from the ceiling overhead. The member moves progressively from one station to another until all details are completed.

Upon completion of the Progressive welding operations on the merry-go-round the member proceeds through a number of stages in the arc welding booths where it (*Turn to p. 50, please*)

Factory Routing Front Wheel Steering Knuckle Support Arm

OPERATION AND EQUIPMENT

Straddle mill king pin bosses—**Ohio mill.**
Drill ream tap both ends—drill and ream king pin hole—**Greenlee three-way drill.**
Finish mill king pin bosses—**Cincinnati mill.**
Chamfer king pin holes—**Nash special burring machine.**
Finish broach king pin hole—**Oilgear double pull broach.**
Drill and ream lock pin holes—**Barnes drill.**
Rebroach king pin hole—**General flexible press.**



Hugh Greenlee three-way, four-station machine for the Ambassador steering knuckle support arm. As illustrated, the fixture takes two arms per station. The tooling is arranged for the drilling, reaming, and tapping of both ends; and reaming of the king pin bore which is handled by the rear way.

Mono-shift Mechanism Added

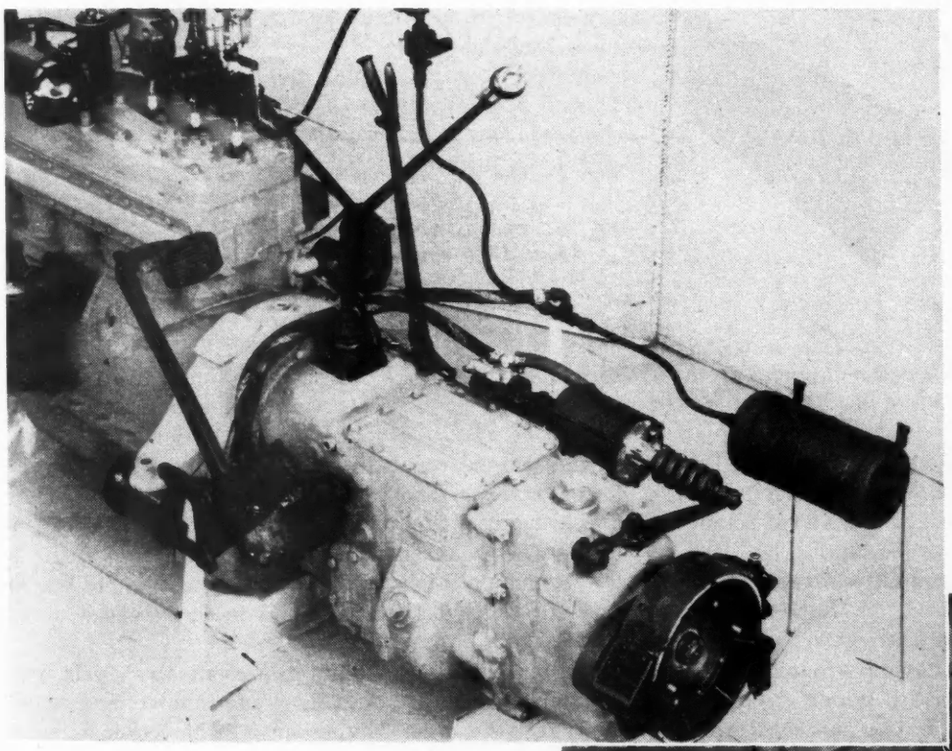
to Mack Transmission

POWER shifting of the two-speed auxiliary gearset is provided by the Mono-Shift mechanism which has been introduced by the Mack-International Motor Truck Corp. on its Duplex 10-speed transmission. This development incorporates pre-selection of the gear ratios and synchronized shifting.

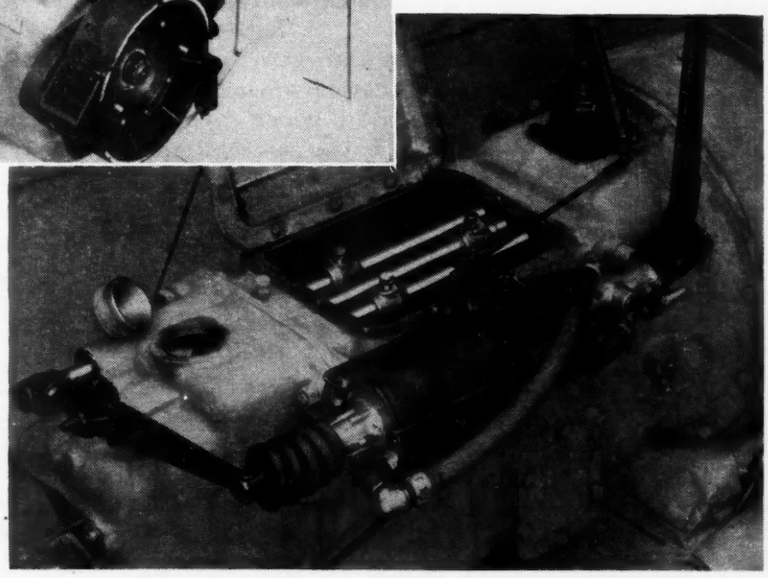
Essentially, the Mono-Shift comprises a single vacuum power cylinder for actuating the two-speed compound shift. This cylinder is supplied with atmospheric air and vacuum from a selector valve, controlled by a finger operated "flipper" on the gearshift lever. A flexible shaft within the tubular lever connects the two. Where a Diesel engine is used, air operation can be made available instead of the vacuum power cylinder.

Forming a part of the clutch release rod is a simple disk-type master valve, supplying vacuum from the intake manifold to the selector valve. The selector valve merely determines on which side of the actuator cylinder the vacuum will be provided. The master valve, which is open when the clutch is released, supplies the necessary vacuum connection. Thus, preselection by means of the flipper is possible and the actual shift is effected only when the clutch is released. Instantaneous response is assured by a separate vacuum reservoir, guarded by a check valve, providing power even when a wide open throttle may temporarily lower the manifold vacuum.

The flipper may be turned at any time — before, after, or during a main ratio shift—due to the action of the master valve. Quick, certain, clashless shifts are said to be assured by the use of a shift synchronizer of new design. It is a multiple - disk friction element type, and its positive balking action makes it impossible for the teeth of the shifting clutch to engage until their speeds are synchronized.



(Below) Close-up of vacuum cylinder and selector valve, with mechanical connection to gearshift lever flipper.



(Above) Mack Mono-shift Duplex 10-speed transmission, showing master valve operated by clutch pedal; selector valve operated by gearshift lever flipper, vacuum cylinder, shifting beam for compound gearing and vacum reservoir.

Why Octane Number

True Anti-

by H. W. Best
U. S. Army Ordnance
CFR Committee,

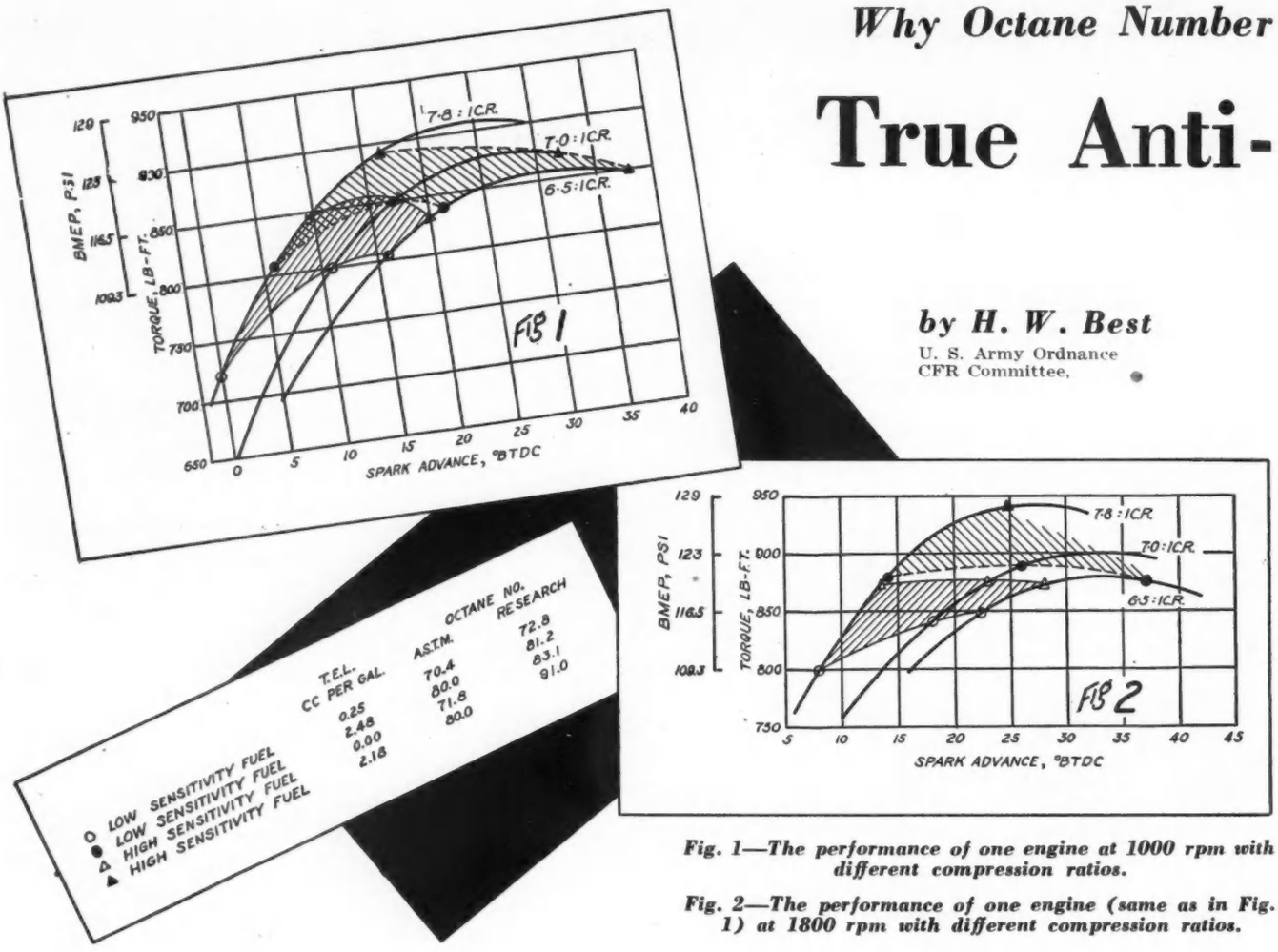


Fig. 1—The performance of one engine at 1000 rpm with different compression ratios.

Fig. 2—The performance of one engine (same as in Fig. 1) at 1800 rpm with different compression ratios.

GASOLINES of the same ASTM octane number from different sources or produced by different refining processes may vary considerably in actual anti-knock behavior. For this reason the CFR Research Octane number or "sensitivity," which is the CFR Research Octane number minus the ASTM octane number, as well as the ASTM octane number is often used to predict the anti-knock qualities of a fuel in full-scale engines.

The possible discrepancy between ASTM octane number and actual anti-knock behavior is illustrated in Fig. 1, which shows the relationship in one engine at 1000 rpm between compression ratio, spark advance for borderline knock and torque with four special fuels. The torque-spark advance curves with a non-knocking fuel are shown for each of three compression ratios 6.5 to 1, 7.0 to 1, and 7.8 to 1. On these curves are indicated the spark advance giving borderline knock with each of the fuels. The upper points represent a fuel of 80 ASTM octane number and sensitivity of 11. With this fuel the spark could be set for optimum torque at the two lower compression ratios without knock. At the highest compression ratio the spark had to be retarded approximately 6 deg, but the resulting torque was still somewhat higher than at the lower ratios. The lower points indicate borderline knock, using a fuel of approximately 70 ASTM octane number with a sensitivity of 2. With this fuel the lowest compression ratio gave the maximum knock-free torque, but the spark had to be retarded about 13 deg from optimum.

The intermediate points represent two fuels, one of approximately 72 ASTM octane number and sensitivity 11, the other having an ASTM octane number of 80 and sensitivity of 1. With both of these fuels the maximum knock-free torque was obtained at the intermediate compression ratio and then they were about equal in anti-knock quality. At the low compression ratio the low sensitivity 80 ASTM octane number fuel was slightly better than the high sensitivity of 72 ASTM octane number fuel, but at the highest compression ratio the reverse was true, and in this case a 72 ASTM octane number fuel was better than one of 80 ASTM octane number. The engine with the 7, 8 to 1 compression ratio was well suited to run with the high sensitivity 80 ASTM octane number fuel but may well have given trouble with the low sensitivity fuel of same ASTM octane number.

This article is based on the paper, "The Significance of Octane Number," which was presented by Mr. Best at the January meeting of the SAE Metropolitan Section. Data in it were taken from reports of the Full Scale Detonation Analysis Group (CFR Committee, U. S. Army Ordance) of which the author is leader. Where octane numbers of fuels are given in the text or charts (Figs. 6, 7 and 8), and the kind of octane number is not indicated, they are ASTM octane numbers.

Does Not Always Represent the

Knock Value of a Gasoline

Although, as in this case, knowing the sensitivity as well as the ASTM octane number of a fuel is very often an aid in predicting its actual anti-knock behavior, it is by no means infallible; that is, two gasolines of the same ASTM octane number and same sensitivity often differ very noticeably in actual anti-knock value. Fig. 2 presents similar data on the suitability of these same four fuels when used in this engine at higher engine speeds.

The curves shown in Fig. 3 illustrate the effect of fuel type on the anti-knock value in full scale engines. The curves for gasolines A and B are the average of ratings in six engines of the high sensitivity and low sensitivity 80 ASTM octane number fuels, respectively. The curve for gasoline C is the average of ratings obtained in two other engines using a fuel of the same ASTM motor and CFR Research octane number as gasoline A but of different chemical composition. In the two engines in which C was tested another gasoline similar in composition to gasoline A and from the same refinery that produced gasoline A was also tested and shown to have characteristics similar to those shown by A in the five engines.

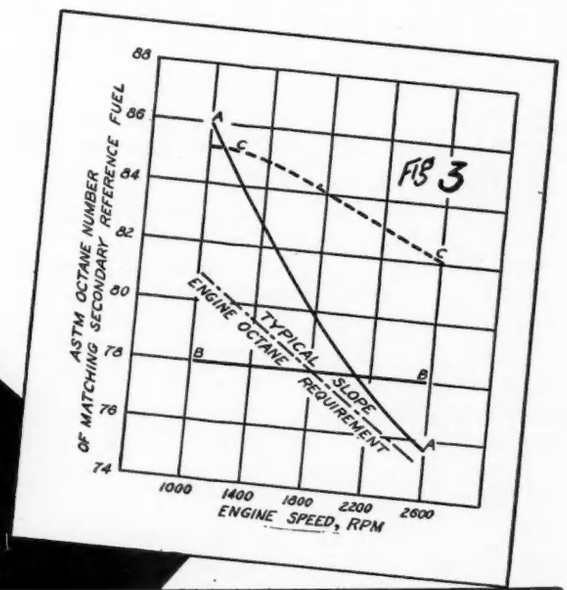
The insensitive fuel B had the same anti-knock value throughout the speed range, two octane numbers below the ASTM octane value. The sensitive fuel A was considerably better than B at low speeds but at high speeds, over 2100 rpm, it was poorer. In general, present day engines require less anti-knock value at high speeds than at low speeds, as indicated by the curve showing typical engine octane requirement. Thus fuel A would be better adapted for conventional engines than fuel B because of its better low-speed, anti-knock qualities.

Fuel C with the same ASTM motor and CFR Research octane number as A is approximately the same as A at low speeds but is considerably better than A or B at high speeds.

Thus from examination of these curves the following points can be noted: 1. Both "sensitive" gasolines A and C have more usable anti-knock value than the

Fig. 3—Variation in equivalent ASTM octane number with engine speed; based on average results in six engines.

	ASTM	CFR Research
Gasoline A.....	80.0	90.0
Gasoline B.....	80.0	80.0
Gasoline C.....	80.0	90.0



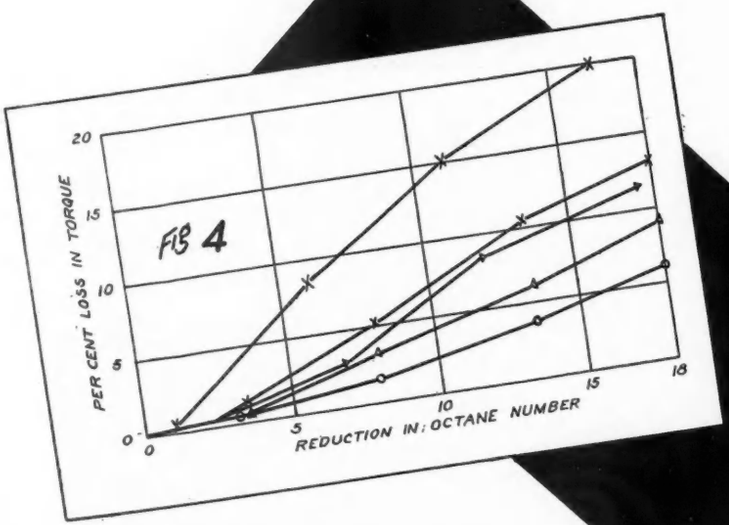


Fig. 4—Effect of decreasing octane number on torque, spark adjusted for borderline knock with reference fuels, based on optimum spark advance at 100 rpm.

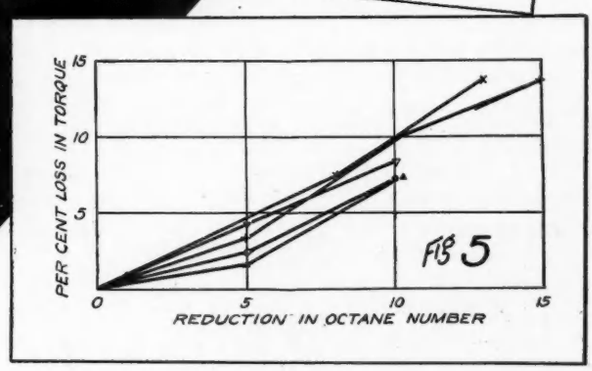


Fig. 5—Effect of decreasing octane number on torque, spark adjusted for borderline knock with reference fuels, based on optimum spark advance at 1800 rpm.

Fig. 7—Effect of changes in intake air temperatures on BMEP at various spark settings (1000 rpm). This test was made with a different engine from that used to get data for Fig. 6.

Fig. 6—Effect of changes in intake air temperatures on BMEP at various spark settings.

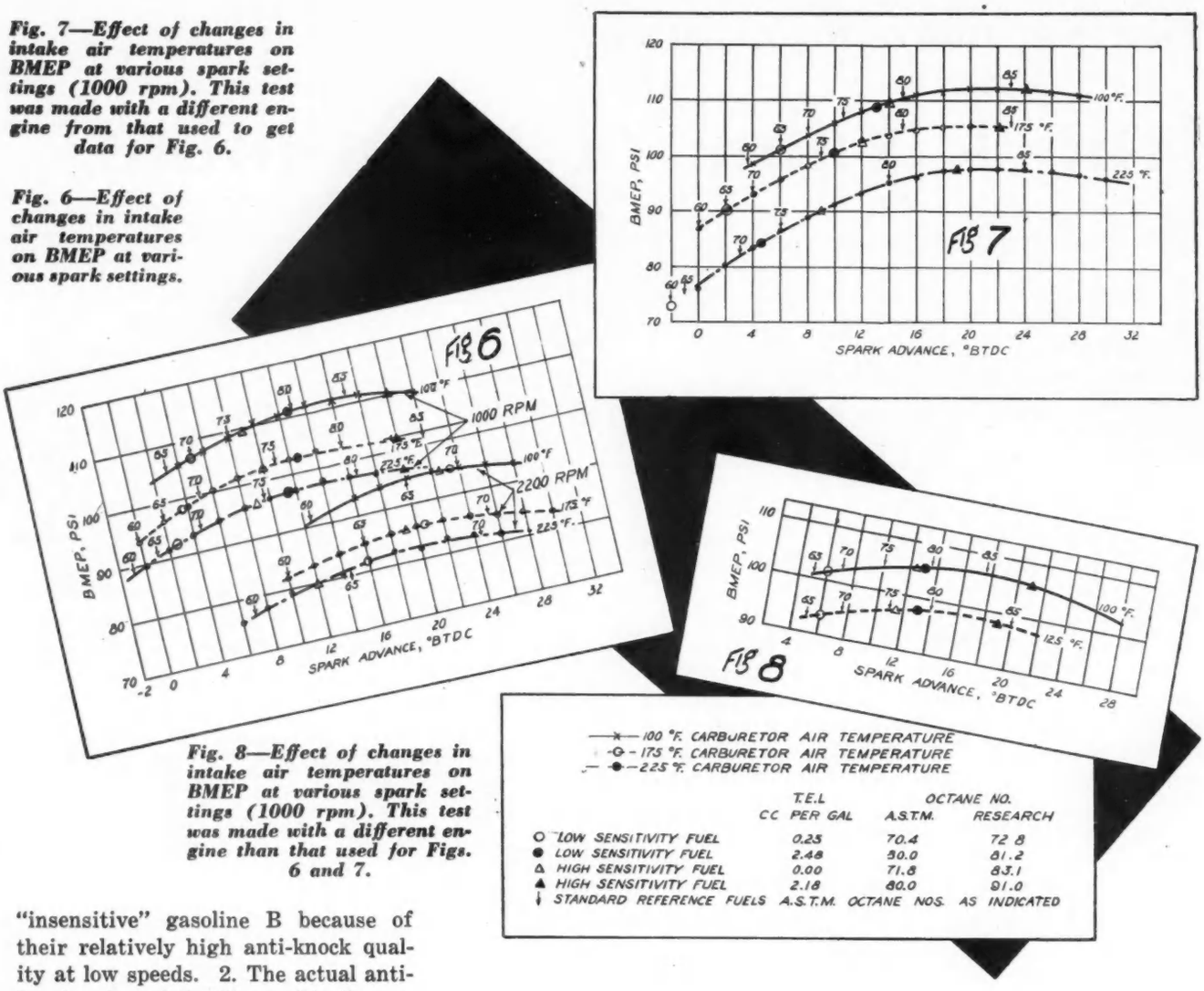


Fig. 8—Effect of changes in intake air temperatures on BMEP at various spark settings (1000 rpm). This test was made with a different engine than that used for Figs. 6 and 7.

"insensitive" gasoline B because of their relatively high anti-knock quality at low speeds. 2. The actual anti-knock value of the "insensitive" gasoline B is two octane numbers below the ASTM octane value at all speeds. In view of the relatively poor low-speed, anti-knock quality of this type of fuel, it would have to have considerably higher ASTM motor method octane number than the sensitive fuels to give comparable road performance in the average present-day commercial engine. 3. The difference in actual anti-knock value between gasolines A and C (both having the same ASTM motor and CFR Research octane values) could vary considerably because of their difference in high-speed, anti-knock quality.

Since the value of good anti-knock properties in a fuel lies in the fact that it allows more power to be obtained from an engine, it may be of interest to examine briefly the effect of octane number on knock-free power. Fig. 4 shows that the effect of a given change in octane number on the knock-free power developed may vary considerably. In these tests the octane number of the reference fuel required to give borderline knock with the spark set for maximum torque in each of five engines was determined at various speeds. The spark position required to give borderline knock on reference fuels of lower octane numbers was then determined and the resulting torque noted. The curves show the per cent loss in torque which resulted as the lower octane number fuels were used. It can be seen that there is a considerable difference in the loss in torque with a given reduction in octane number. For example, a reduction of 10 octane numbers in one engine resulted in a 14 per cent loss in torque at 1000 rpm, whereas a 10 octane number reduction in another engine produced only a two per cent loss in torque. Thus in respect to torque output, what an octane number meant to one engine was something quite different to another engine.

The data shown in Fig. 5 was obtained at 1800 rpm in the same engines as those shown in the previous figure. The difference between engines was not as great as at the lower speed. However, in some of the engines an increase in speed produced a greater effect on torque of a given reduction in octane number; in others the reverse was true.

Figs. 6, 7, and 8 show the effect of changes in intake air temperature on engine power and borderline knock, using different test and reference fuels in several engines. On the BMEP—Spark Advance curves at different intake air temperatures are indicated the spark advance at which borderline knock occurred with various test and reference fuels. These curves show

(*Turn to page 48, please*)

Wartime Developments

Revealed at the National Metal Exposition

THE so-called "lost wax" technique, refined and brought up to date in recent years, during the war provided the basis for a new industry. Precision castings of steel and hard alloys as well as of non-ferrous alloys were produced by a large number of companies under a top secret program for the war.

Most of the producers of precision castings by this method were among the 450 odd exhibitors at the 27th National Metal Exposition held in Cleveland early in February. Covering some eight acres of floor space and entailing mile upon mile of foot work, this Exposition was probably the greatest spectacle in engineering circles up to this time. Some impression of the activity may be gained from the fact that well over 40,000 people — chemists, metallurgists, production men, and just interested folks—thronged the aisles day after day.

Persistent rumor had it that the American Society for Metals would shortly announce another spectacle to be held in Atlantic City in the Fall of 1946. Among other reasons a second show in the same year is said to be an opportunity to show the offerings of many organizations who could not be accommodated in Cleveland, also presumably to emphasize products and techniques being readied for the 1947 market.

A realistic appraisal of the Cleveland show indicates little that was startlingly new since most metallurgists who had anything to do with the war program came in contact with most materials and processes used or developed during the war. Nevertheless, many of the things exhibited are new to many people and, in any event, much of what was shown is being made available for civilian use for the first time since the war began.

Because of its gargantuan size the Exposition was not easy to cover and is even more difficult to describe within the limits of a single article. What is offered here is a sampling of products and processes. This sampling will serve to provide a perspective of the scene, although it falls far short of giving credit to everyone who participated.

In an effort to present a concise picture for quick reading, the material is arranged in 12 classifications. The selected items appear within each classification either by title only or supplemented by brief comment wherever desirable. Before proceeding with the formal description a few comments will be made concerning some special exhibits which are not otherwise classified.

First of all, one of the busiest booths was Jack & Heintz whose all-aluminum six-cylinder sleeve valve engine prototypes of airplane and motor car power units attracted considerable attention. The aircraft engine has a rating of 95 hp while the motor car engine is rated at 75 hp. The company also showed part of its line of ultra-modern electronic inspection devices, particularly the bearing ball sorting machine which was in constant operation.

By Joseph Geschelin

Hupp Motor Car Corp. and its affiliate, the Globe Stamping Div., had an interesting display of parts and stampings illustrating the present program of this organization to be of service to the automotive industry as a contracting source.

The Lectro-Count, a unique electronic device for installation on high production metal cutting machines was shown by the Lansing Engineering Co. This unit has a remotely installed recording mechanism which is located in a central control office to provide a continuous record of production. In addition to counting, the machine can be employed for making accurate time studies without actual contact with the operator.

Udylite Corp. had a line of its latest equipment including an enormous automatic plating machine. Infrared equipment for industrial drying, baking, and heating was demonstrated by Fostoria Pressed Steel Corp., and the Miskella Infra-Red Co.

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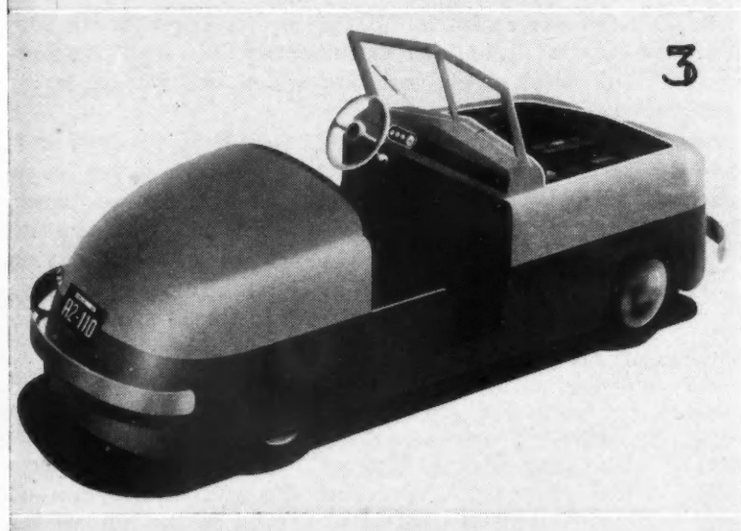


The

1 — Bobbi-Kar two-passenger convertible coupe, with the top in place, scheduled for 1946 production.

2—Station wagon, an artist's version of another proposed body type.

3—The package car, a "pick-up and delivery" version of the convertible coupe with the right section of the passenger compartment floor board removable to extend the package compartment back into the passenger compartment if desirable.

4—Two-door Sedan, an artist's version of a body type proposed for future production.

DESIGNED for the low price field, the Bobbi-Kar recently made its first public appearance in two body types, a convertible coupe and package car, which are to be supplemented in a short time by a two-door sedan and station wagon, according to the Bobbi Motor Car Corp., of San Diego, Calif., where the showing was held. Manufacturing cost estimates indicate a selling price range from $500 to $600 for the four body types at San Diego, subject to Office of Price Administration approval.

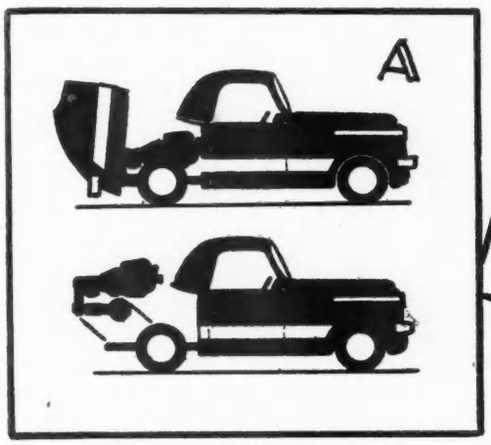
Specifications

	Convertible Coupe and Package Car	Proposed Sedan and Station Wagon
Wheelbase	80 in.	100 in.
Overall length	132 in.	161.5 in.
Turning radius	13.42 ft	16 ft
Tread	42 in.	50 in.
Seat width	43 in.	46 in. front
Tires	4.50-12	5.00-15
Suspension	All four wheels independently sprung. Torsilastic rubber torsion type springs.	
Frame	Tubular steel, X-trussed.	
Baggage space	Package compartment under the front hood.	

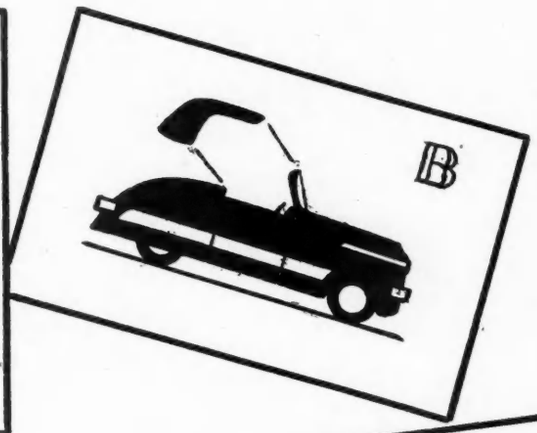
Engine (for all body makes):	
Make	Hercules, Model ZXB
Number of cylinders	4
Bore and Stroke	2⅝ in. by 3 in.
Piston displacement	64.9 cu in.
Taxable hp	11
Max. hp	25
Lubrication	Pressure feed to all connecting rod and main bearings.
Valve arrangement	L-head
Piston material	Cast iron
Cooling system	Thermo syphon (water pump available)

By R. Raymond Kay

Bobbi-Kar

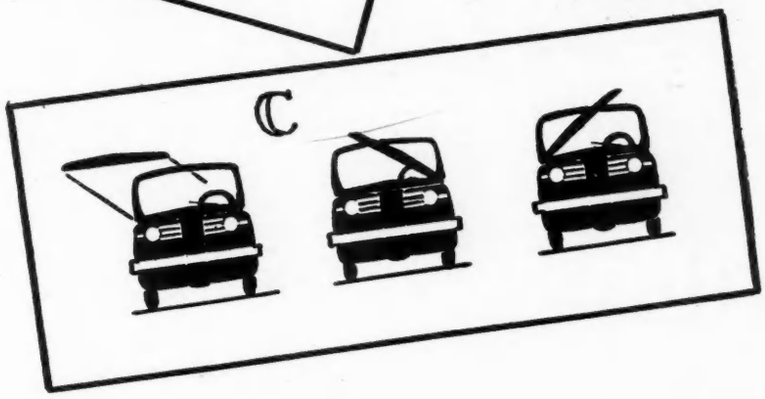


A—The rear deck is hinged at the back and can be raised for access to the engine. The hinge-latch can be unfastened to completely remove th rear deck. The engine, clutch, transmission, and differential are designed to be removable as a unit.



B — Releasing the latches above the windshield and at the rear deck line permits removal of the plastic top which can then be stowed in the front end package compartment.

C — The hood may be raised from either side or removed by releasing the hinge-latches on both sides at once.



The car weighs approximately 1000 lb and is powered by a Hercules 25 hp four-cylinder water-cooled engine located at the rear of the chassis. Top speed is said to be 65 mph and fuel mileage 40 miles per gallon. Production is contemplated in two converted aircraft plants at Chula Vista and National City, near San Diego. The company states that it expects by February, 1947, to have an output of 5000 cars per month. National distribution is planned.

The chassis is constructed around a tubular X-type frame with all four wheels independently sprung. Early cars were equipped with coil springs, but models now have rubber torsion springs. Brakes are the hydraulic type. Standard 12-in. drop center wheels are used with low pressure tires.

The power application contains several innovations. The engine, flywheel, clutch, and housing, transmission, and differential have been combined into a single compact unit. This entire unit is supported on three-point rubber mountings between the side members of the frame. Propeller shafts extend from the differential to the driving spindles of the rear wheels. Each propeller shaft has two universal joints. By removing four bolts from the flange of each inner universal joint, and three engine mount bolts, it

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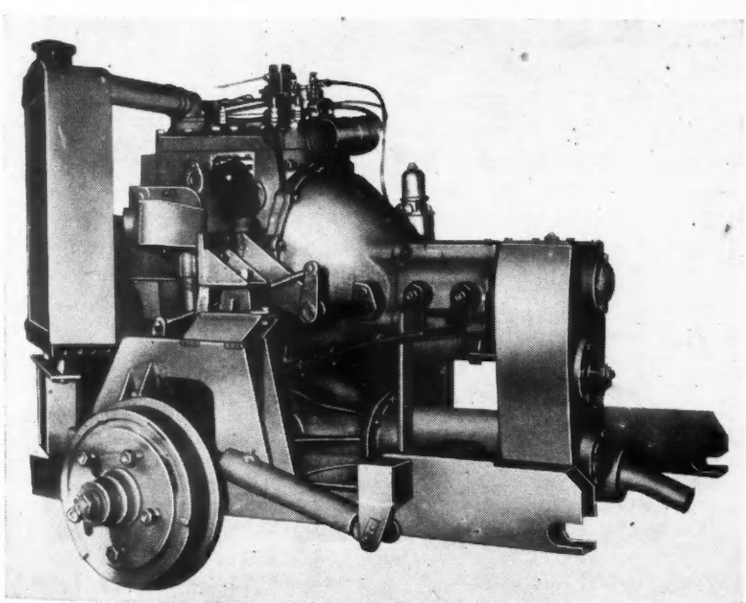
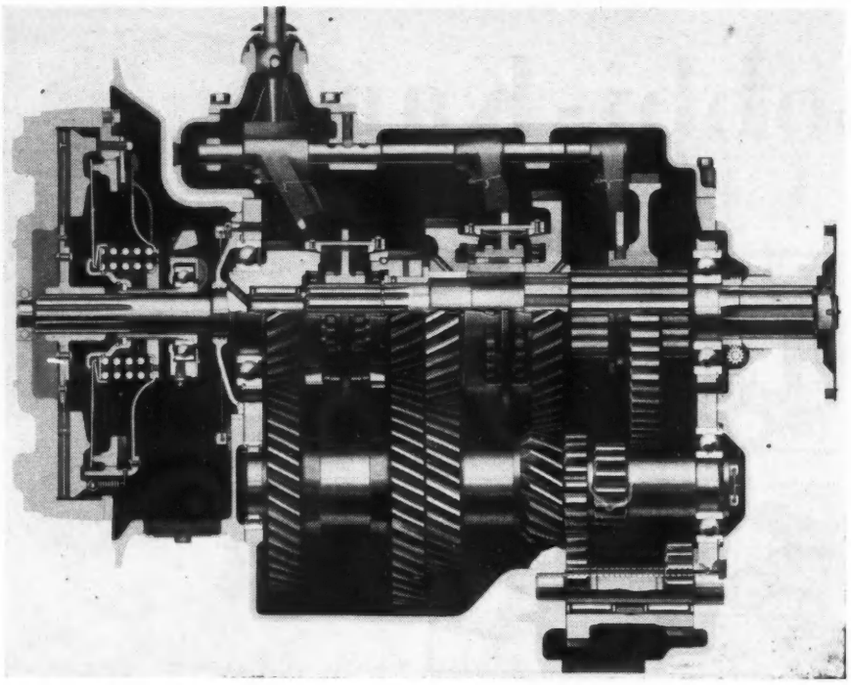


Bobbi-Kar engine installation.



Spicer's New Line of

Heavy Duty Transmissions

AN IMPROVED line of synchronized heavy duty transmissions for motor trucks, buses and other types of vehicles is announced by the Spicer Mfg. Co. Having built synchronized transmissions 10 years for bus and truck use, Spicer during the war supplied five-speed synchronized transmissions for the British Valentine tanks and to the Russians for their tanks. In addition, over 30,000 units were supplied to the U. S. Armed Forces for installation in the light tanks and in the famous LVT's.

The line consists of two five-speed models — the Model 6252 with direct on fifth; Model 6253 with direct in fourth and overdrive on fifth. For all forward speeds except low, the gears are of helical type, the low and reverse being spur gears. To assure easy shifting and to reduce gear replacements to a minimum, the large blocker type synchronizer is used on 5th, 4th, 3rd, 2nd, and overdrive. The constant mesh gears on the main shaft are carried on fluted bearings.

Numerous interesting design features common to both transmissions are given here. In the first place, all gears are made from upset forgings of a three-way high quality gear steel and are carburized, re-heated, and tempered, to give a Rockwell hardness of C 59-62. All shafts are mounted on anti-friction bearings selected specifically for the application of the unit.

Shift rails are interlocked in such fashion that only one speed at a time can be engaged. Sliding clutches that pick up the various helical gear speeds are provided with an arrangement making it impossible for speeds to work out of engagement while in operation. The gear case, clutch housing, bearing caps, etc., are made of high quality close grain cast iron. The forks are drop-forged, heat treated, and hardened at all wearing areas.

The gear boxes are provided with a large SAE power-take-off opening on each side. Weight of the assembly, less the clutch, is 410 lb; oil capacity is 15 pints. There is a choice of Spicer clutches, the 14-in. single plate or 13-in. two-plate being available. Provision is made for clutch adjustment through the bottom of the clutch housing. The gear ratios for the two models are as follows:

	Model 6252	Model 6253
Reverse	7.70 to 1.00	6.09 to 1.00
First	7.81 to 1.00	6.07 to 1.00
Second	4.67 to 1.00	3.41 to 1.00
Third	3.06 to 1.00	1.79 to 1.00
Fourth	1.72 to 1.00	1.00 to 1.00
Fifth	1.00 to 1.00	0.78 to 1.00

Production of New Cars Still Proceeding on Limited Scale

Even with Adequate Steel Supplies, Peak Output Not Expected to be Reached for Three or Four Months

Although the steel strike is settled and mills are rapidly approaching full production, volume output of automobiles still is many weeks off. A survey among vehicle and parts manufacturers in Detroit fails to unearth any particular optimism that peak production is in sight. Opinions vary as to how long it will take to get all difficulties ironed out, with guesses ranging from 10 weeks to six months. It always is precarious to speculate on such a question, but probably the best general guess would be three to four months.

How long it takes for companies which were forced to close or to curtail operations because of the steel strike to get going again is shown by the case of Ford. A company spokesman estimates that it will be at least two weeks after suppliers start to make deliveries before Ford can resume operations at the Rouge plant. The company does not stockpile parts to any degree, so it has no reserve to work on. That is why it will be necessary to allow a couple of weeks to get all components flowing into the lines again. The branch plants will resume in the order of their closing, which means that the Richmond and Long Beach, Cal., plants, last to close, probably will not start up again for at least 30 days.

Companies which have managed to continue production on a limited scale during the strike are uncertain whether they will be able to continue uninterrupted production until the flow of steel to suppliers again is normal. Many parts builders had been living off their fat during the steel strike and in some cases it is doubtful whether they can bridge the gap until new steel supplies come in. Chrysler Corp., which was slow to get into production apparently is in fair shape. This is indicated by the fact that all divisions now have announced their cars. The company's position was that new car announcements would be delayed until assured continued production was in sight.

Nash and Studebaker both are in fair shape to continue limited production, with Studebaker probably a little better off of the two, since it had an opportunity to build up a large stockpile of parts during its prolonged shutdown last year. Hudson has shown signs of parts trouble in recent weeks. Supplies of components have been hand-to-mouth for some time there, and around the middle of February assembly line operations were erratic. Packard, which has not turned a wheel since Jan. 24, has dim prospects for resuming production for some time, unless it can obtain engine bearings from some other source than G.M., which seems very unlikely. The supply of bearings from the Moraine Products Div. of G.M. is not expected to start flowing to Packard until from two to three weeks after the end of the strike.

Even though steel supplies are adequate, there are still many clouds on the horizon so far as peak production of automobiles is concerned. The situation in parts industry in regard to labor and prices is so unsettled at the moment that until some order is brought out of it, there is a continuing hazard of parts shortages. The plain simple truth of the matter is that the government's wage price program has obfuscated the situation much more than it has helped. Organized labor is making demands for wage increases similar to those granted by the car manufacturers. However, the parts makers raised wages during the war more than the vehicle makers did in many cases and an increase on the 18-18½ cent pattern would put them out of line. So far there have not been enough wage settlements in the parts industry to establish a pattern and consequently the parts makers do not know how much they are going to be required to raise wages. Another complication is that many original equipment parts are not under ceiilngs, posing the question of whether the car manufacturer can give an increase to the parts supplier and then apply for a higher ceiling price on his automobile. Although the higher price of the part would be a direct result of the pay increase to labor it still remains to be determined whether OPA will recognize it as such and allow the automobile builder to apply for price relief. The parts maker is in the unhappy spot of not being able to appeal directly to OPA, unless his product is one of the few still under ceilings, and therefore must wring any price boost out of the customer. The general consensus is that it will take several weeks to get the troubles of the parts industry settled, and until that is done, the flow of parts is likely to be faltering.

One angle overlooked by those who predict a quick stepup in volume is that most General Motors parts divisions were closed during the entire strike, the exceptions being those under contract with the United Electrical Workers. A strike of about a month in the divisions with the UER contracts was settled by an 18½-cent increase. Thus, while the inventory of electrical parts should be large, the stocks of other components made by G.M. was negligible at the start of the strike and it will take several weeks to build a backlog. Since G.M. also supplies practically every other company with one or more components, it will either have to fill its own supply liens at the expense of its customers or take care of the other companies, resulting in smaller deliveries to its own divisions. Either way, production of cars will be slow until inventories are built up.

All in all, the way it adds up to most automotive industry men in Detroit, it is going to take a lot longer to get the industry shaken down and running smoothly than is generally believed by the public at large. Labor, prices, and supplies are big problems that must be ironed out before volume production is reached.

Geo. W. Mason Elected President of AMA

George W. Mason, president of Nash-Kelvinator Corp., has been elected president of the Automobile Manufacturers' Association to succeed Alvan Macauley, chairman of the board of Packard Motor Car Co., whose resignation as president of the manufacturers' association was accepted by the board of directors at their meeting in Detroit. Elected a director of the industry's organization in 1913, Mr. Macauley had served as its president for 18 years.

George Christopher, president of Packard, was elected to succeed Mr. Mason, who had previously served the industry as treasurer of the Association. Other officers are: Paul G. Hoffman, president of Studebaker Corp., vice-president; Robert F. Black, president, White Motor Co., vice-president; Albert Bradley, executive vice-president, General Motors Corp., secretary, and George Romney, general manager.

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

Chrysler Corp., **D. A. Samson,** Budget Director.

Chrysler Corp., DeSoto Div., **J. B. Wagstaff,** Vice-President.

Kaiser-Frazer Corp., **M. A. Davey,** Asst. Treasurer.

Willys-Overland Motors, **Robert R. Thien,** Director of Marketing; **Lyle E. Calkins,** head of Chemical Laboratories.

Stewart-Warner Corp., **Leo B. Pambrun,** Asst. Advertising Manager, in charge of Radio Div.

The Electric Furnace Co., **K. U. Wirtz,** Executive Vice-President; **C. L. West,** Vice-President given complete charge of all sales and sales engineering; **C. H. Vaughan,** Asst. Vice-President.

The Fellows Gear Shaper Co., **Edwin R. Fellows II** appointed Export Manager.

Pittsburgh Plate Glass Co., Ditzler Color Div., **E. Dudley Kress,** Asst. Sales Manager.

The R. K. LeBlond Machine Tool Co., **Sidney R. Best,** Advertising Manager, succeeding **Walter L. Rybolt.**

Westinghouse Electric Corp., **Frank D. Newbury,** elected a member of the Board of Directors.

F. L. Jacobs Co., **Dudley H. Waters,** elected a director of the company.

Institute of the Aeronautical Sciences, **Captain S. Paul Johnston, USNR,** appointed a Director; **Peter Altman,** Detroit Engineering Consultant, elected a member of the Council to represent Central Aero of the United States.

Empire Tool Co., Inc., **Howard N. Girardin,** Asst. to the President.

Dayton Rubber Mfg. Co., **L. B. Gordon,** Director of Engineering.

Service Station Equipment Co., **A. J. Jordan,** appointed Vice-President and Director of Sales for Bennett-Eco products.

The Crescent Co., Inc., **John M. Sapinsley,** elected Treasurer.

The Reliance Electric & Engineering Co., **Edward E. Helm,** elected Sales Vice-President.

General Box Co., **James Ferguson,** Sales Manager.

The Cleveland Pneumatic Tool Co., **George P. Torrence,** President and **John S. Clark,** Vice-President and Treasurer, resigned.

Cold Metal Products Co., **L. A. Beeghley,** Chairman of the Board; **W. B. Lockwood,** President and **C. M. Beeghley,** Vice-President.

American Chain & Cable Co., Inc., **Wilmot F. Wheeler,** President; **Cyrus N. Johns,** Executive Vice-President; and **Stanley Mann,** Treasurer.

Consolidated Vultee Aircraft Corp., **Carl Havens,** assistant to **W. A. Blees,** vice-president in charge of sales.

Aeronautical Manufacturing Division of The B. F. Goodrich Co., **John H. Seaton,** Manager.

American Brake Shoe Co., **Roger W. Batchelder,** General Purchasing Agent.

Dodge Division, Chrysler Corp., **Leo F. Desmond,** Kansas City Regional Manager.

Federal-Mogul Corp., **M. A. Hunter,** Board of Directors.

Westinghouse Electric Corp., **L. E. Osborne,** senior operating Vice-President.

Westinghouse Electric Corp., **R. W. Gemmell,** Manager of Aircraft Sales Dept.

Jessop Steel Co., **Robert A. Parks,** General Sales Manager.

Castle-Werner, Inc., **Richard S. Werner,** General Manager.

Ford Motor Co., **David W. Lee,** head of truck advertising division.

Reo Motors, Inc., **A. W. Zimmer,** Works Manager.

General Motors Corp., **King D. Boyd,** District Manager of Petroleum Industry Sales.

Ford Motor Co., **Donald E. Irwin,** Industrial Relations Manager of the Lincoln Division.

Chrysler Corp., **Henry C. Riefe,** Portland Regional Manager for Dodge.

Optimus Equipment Co., **Grover C. Schantz,** Production Superintendent.

Essex Wire Corp. and Paranite Wire & Cable Division, **W. D. Barnes** and **John W. Stewart,** sales representatives.

Packard Motor Car Co., **Earl L. Coppock,** Manager of sales promotion department.

White Motor Co., **Elbridge Teel,** White Horse Sales & Development Engineer.

General Controls Co., **Edgar P. Hollister,** Manager of New York Factory Branch.

Bliss & Laughlin, Inc., **Robert W. Ritchie,** Metallurgical Engineer.

Studebaker Corp., **P. D. Welch,** merchandising director; **T. F. Kilcommons,** eastern zone manager; **F. T. Corcoran,** western zone manager.

General Motors Corp., **J. D. Thompson,** zone manager at Charlotte, N. C., for Chevrolet Motor Division.

Willys-Overland Motors, Inc., **James W. Schiefer,** head of planning section.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE *and* AVIATION INDUSTRIES

General business activity has shown further recession. The *New York Times* index for the week ended February 2 stands at 113.5 as compared with 114.3 for the preceding week and 146.1 a year ago.

Electric power production during the same week registered a contraseasonal increase. The output was 11.6 per cent. below the comparable amount last year, as against a similar decline of 12.2 per cent. reported for the week before.

Railway freight loadings during the week ended February 9 totaled 713,240 cars, 1.4 per cent. fewer than for the preceding week and 5.6 per cent. below the corresponding number a year ago.

Crude oil production in the same week averaged 4,690,500 barrels daily, 81,300 barrels more than the preceding weekly output but approximately one per cent. below the comparable figure in 1945.

Bituminous coal and lignite production during the week ended February 2 totaled 12,630,000 net tons, 0.8 per cent. more than the output in the week before and 12 per cent. above that a year ago. The amount thus far reported in 1946 is 0.9 per cent. above the corresponding quantity recorded last year.

Civil engineering construction volume reported for the second week of February by *Engineering News-Record* is 21 per cent. less than the preceding weekly figure but slightly greater than the amount registered a year ago. The seven-week total shown for 1946 is $447,862,000, or 147 per cent. more than the comparable sum in 1945.

The wholesale price index of the Bureau of Labor Statistics for the week ended February 9 rose to 107.1 per cent. of the 1926 average, as compared with 106.8 for the week before and 104.9 a year ago.

Member bank reserves declined $24,000,000 during the week ended February 13. Underlying changes reflected include a rise of $93,000,000 in Reserve bank credit and an increase of $148,000,000 in Treasury deposits with Federal Reserve banks, accompanied by an expansion of $38,500,000 in money in circulation.

Total loans and investments of reporting member banks increased $12,000,000 during the preceding week. A rise of $42,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $7,342,000,000, shows a net increase of $996,000,000 in twelve months.

PUBLICATIONS

Thompson Products, Inc., has issued a new 32-page booklet enumerating the advantages of both **jet** and **reciprocating type engines.** It is well illustrated and describes in non-technical language how jet engine operates and some of the things science is doing to improve this new source of power.*

An attractive booklet, **Presenting Sterling,** and published by Sterling Aluminum Products, Inc., gives a condensed picture of the company, the products it manufactures and the personnel.*

Danly Machine Specialties has announced a new series of **Dowel Pin Drill and Reamer Charts** cataloging their line of precision dowel pins. The 1-page chart contains drilling and reaming instructions for dowelling in cast iron and steel. Charts are prepared on cardboard and light paper stock, in plain and varnished finishes, convenient for shop display and use.*

A 20-page pocket-size booklet, **Water-Mixed Cutting Fluids,** containing practical information for users of so-called soluble oils, has been published by D. A. Stuart Oil Co. Feature articles are Cutting Fluids and Hygiene, Design Data, for Cutting Fluid Systems, with accompanying charts.*

Cincinnati Milling and Grinding Machines, Inc., has issued a new booklet on its **grinding machines**—No. G-536. Included in the descriptions are Centertype Grinding Machines, Centerless Grinding Machines and Centerless Lapping Machines. Dimensional drawings and general specifications are given for all models.*

The Simmons Fastener Corp. has issued a new and revised catalog of its products, including the latest data and specifications on **Quick-Lock, Spring-Lock** and **Lock-Nut Fasteners.** Descriptions, drawings and specifications for the various types are included.*

Bulletin No. 190, **Lindberg Controlled Atmospheres for Heat Treating,** describes and illustrates four distinct types of neutral heat treating atmospheres, tells how they are produced, cost per one thousand cubic feet of each and lists many applications for which each may be employed.*

A 100-page pocket-size handbook presenting practical information on 26 types of **stainless steels** has been published by Allegheny Ludlum Steel Corp. It contains a 44-column finder chart giving analyses, properties, hot working temperatures and heat treatment of the different types, and a general discussion of types and properties of stainless. A table of corrosion resistance of four leading types of stainless to 230 chemicals and common materials is also given, together with fabrication methods and procedures describing welding methods, press forming, drawing and blanking, machining techniques, etc. General tables of bar weights, weights of sheet, tubes, decimal equivalents, etc. are included.*

A revised edition of the **Cannon Electric Type AP** Bulletin has been released by Cannon Electric Development Co. The 12-page booklet contains an extensive information section, exploded views of three plugs and one receptacle; dimensional sketches, photographs and application views. Dust caps are also illustrated.*

The Insuline Corp. of America has announced the publication of a new catalog detailing the 1946 line of **antennas** and **antenna accessories.** Included in the catalog are descriptions and specifications of home antennas, F.M. and television antennas, as well as various types of new auto-radio antennas.*

Lepel High Frequency Laboratories, Inc., has a new 32-page catalog of **Lepel high frequency induction heating units.** Illustrated with numerous photographs and drawings, the catalog explains in non-technical language the principal and application of induction heating and its advantages.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

CALENDAR

Conventions and Meetings

Pan-American Aircraft Exposition, Dallas — Mar. 1-5

Second Northwest Annual Airshow, Minneapolis — Mar. 12-18

The Amer. Helicopter Society, Phila. — Mar. 14-15

Amer. Soc. of Mechanical Engineers—Spring Meeting, Chattanooga — Apr. 1-3

American Management Association, Atlantic City, N. J., Packaging Exposition — Apr. 2-5

SAE Natl. Aeronautic Meeting, New York, N. Y. — Apr. 3-5

Midwest Power Conference, Chicago — Apr. 3-5

American Society of Tool Engineers, Cleveland Tool Engineers Exposition — Apr. 8-12

International Lighting Exposition, Chicago — Apr. 25-30

The Chamber of Commerce of the United States — Annual Meeting, Atlantic City — Apr. 30-May 2

Natl. Assoc. of Corrosion Engineers, Kansas City, Mo., Annual Meeting and Convention — May 7-9

Associated Business Papers, Hot Springs, Va., Spring Meeting — May 22-25

SAE Summer Meeting, French Lick, Ind. — June 2-7

Amer. Soc. of Mechanical Eng.—Detroit — June 17-20

SAE Natl. West Coast Trans. and Maint. Meeting, Seattle — Aug. 22-24

SAE Natl. Tractor Meeting, Milwaukee, Wis. — Sept. 11-12

SAE Natl. Transportation and Maintenance Meeting, Chicago — Oct. 16-17

Police to Conduct Safety Check Campaign

Beginning May 15, police in the United States and Canada will conduct a Traffic Safety Check campaign patterned after the brake check drive conducted last year. In addition to brakes, other items included in the 1946 test will be lights, horns, tires, and windshield wipers. Another innovation is that trucks, busses, and taxicabs will be checked this year in addition to passenger cars. The test, which applies only to vehicles involved in moving traffic violations and accidents, is sponsored by the International Assn. of Chiefs of Police.

The campaign is expected to involve increased activity on the part of automobile repair shops and replacement parts suppliers, both of whom will be called on to help put vehicles into safe operating condition.

Campbell-Ewald Organization Celebrates 35th Anniversary

Campbell-Ewald Co., one of the largest advertising agencies in the nation, celebrated its 35th anniversary last month. Founded Feb. 14, 1911, by Henry E. Ewald, it is said to be the oldest advertising agency in the United States founded and still directed by the same person.

The agency still retains its first account, Hyatt Bearings Division of General Motors. It handles the advertising accounts of such nationally known organizations as General Motors, Chevrolet, U. S. Rubber, Norge Division of Borg-Warner, Great Lakes Steel, Stran-Steel, Delco Batteries and nearly a hundred others.

The Chevrolet motor car account, which has been with the agency nearly a quarter of a century, is said to be the largest single industrial advertising account in the country.

RWMA Elects Officers

At the regular meeting of the Resistance Welder Manufacturers' Association, which was held in Detroit, the following officers were elected to serve during 1946: president, H. B. Warren, executive vice president, Thomson-Gibb Electric Welding Co., Lynn, Mass.; vice president, G. N. Sieger, president and general manager of S-M-S Corporation, Detroit, Mich.; executive secretary, George A. Fernley, Philadelphia, Pa.; secretary-treasurer, H. R. Rinehart, Philadelphia, Pa.

Spring SAE Aeronautical Meeting Scheduled for April 3-5 at New York

Discussional planning to meet future engineering requirements of commercial and civil aviation in the United States features the program for the SAE National Aeronautic Meeting (Spring) to be held April 3 to 5 at New York, N. Y. Simplified planes for private owners, selection of aircraft for air transport operations, effective utilization of waste exhaust gases, progress in and applications of jet engines, air lines operating requirements, and use of new materials in aircraft construction are among the subjects of technical papers to be presented.

The meeting will be sponsored jointly by the SAE Aircraft, Aircraft Powerplant, and Air Transport Engineering Activities, with the cooperation of SAE Metropolitan Section. General chairman will be Harold R. Harris, vice president and general manager of American Overseas Airlines, New York. The tentative program follows:

Wednesday morning, April 3, AIRCRAFT SESSION: Chairman, R. R. Higginbotham, of Republic Aviation Corp., Farmingdale, L. I., N. Y.

Pneumatic Tires for Modern Airplanes, by R. D. Evans, of Goodyear Tire & Rubber Co., Akron, Ohio.

A Systematic Approach to the Aerodynamic Design of Radial Engine Installations, by F.V.H. Judd, of United Aircraft Corp., East Hartford, Conn.

AIRCRAFT POWERPLANT SESSION: Chairman, E. A. Ryder, of Pratt & Whitney Aircraft, East Hartford.

Improving Engine Parts by Direct Measurement of Strain, by R. G. Anderson, of Aluminum Co. of America, Cleveland, Ohio.

Testing of Highly Loaded Sleeve Bearings, by J. Palsulich and R. W. Blair, of Wright Aeronautical Corp., Paterson, N. J.

Wednesday afternoon, AIR TRANSPORT SESSION: Chairman, John Chamberlain, of Civil Aeronautics Board, Washington, D. C.

The Planning of Cabin Interiors for Transport Aircraft, by Walther Prokosch of Eastern Air Lines, Inc., New York.

Notes on Loss Prevention in Airline Operation, by Jerome Lederer, of Aero Insurance Underwriters, New York.

Wednesday evening, GENERAL AIRCRAFT POWERPLANT SESSION: Chairman, R. W. Young, of Wright Aeronautical Corp., Paterson.

Performance Characteristics of the BMW 003 and a Comparison with the JUMO 004 Jet Engine for Aircraft, by W. G. Lundquist and R. W. Cole, of Wright Aeronautical Corp., Paterson.

Aircraft Gas Turbines with Centrifugal Compressors, by R. S. Hall of General Electric Corp., West Lynn, Mass.

Thursday morning, April 4, AIRCRAFT SESSION: Chairman, Ralph Upson, of New York University, New York.

A Summary of Design and Test Experience with Monocoque Magnesium Wings, by J. C. Mathes, of Dow Chemical Co., Midland, Mich., and Earl Rottmayer, graduate student, University of Michigan, Ann Arbor, Mich.

The Development of Magnesium Alloys as Aircraft Materials, by J. C. DeHaven, of Battelle Memorial Institute, Columbus, Ohio.

AIRCRAFT POWERPLANT SESSION: Chairman, A. T. Gregory, of Ranger Aircraft Engines, Farmingdale.

The Two-Cycle Engine for Aircraft.

The Crankcase Scavenge Target Engine, by J. L. Ryde, of McCulloch Aviation Co., Los Angeles, California.

Investigation of an Opposed Piston Light Aircraft Engine, by J. W. Oehrli and V. J. Jandasek, of McCulloch Aviation Co., Los Angeles, California.

Fuel and Lubricating Oil Requirements for Personal Planes, by C. T. Doman, of Aircooled Motors Corp., Syracuse, N. Y.

Thursday afternoon, AIR TRANSPORT SESSION: Chairman, W. W. Davies, of United Air Lines, Inc., Chicago, Ill.

Transport Aircraft Selection, by J. G. Borger and L. H. Allen, of Pan American Airways, New York.

Airline Scheduling, by J. D. Hungerford and J. W. Colthar, of American Airlines, Inc., New York.

Thursday evening, GENERAL AIRCRAFT SESSION: Chairman, Fred Weick, of Engineering & Research Corp., Riverdale, Md.

Simplifying the Airplane for the Private Owner, by J. M. Gwinn, Jr., of Consolidated-Vultee Aircraft Corp., San Diego, Calif.

Increasing the Utility of the Private Airplane, by W. T. Piper, of Piper Aircraft Corp., Lock Haven, Pa.

Friday morning, April 5, AIRCRAFT SESSION: Chairman, John G. Lee, of United Aircraft Corp., East Hartford.

Stability Problems with Swept Wings, by H. A. Soule, of National Advisory Committee of Aeronautics, Langley Field, Va.

Effect of Mach and Reynolds Numbers on the Maximum Lift Efficiency, by J. R. Spreiter and P. J. Steffen, of National Advisory Committee for Aeronautics, Moffett Field, Calif.

AIRCRAFT POWERPLANT SESSION: Chairman, R. N. DuBois, of Packard Motor Car Co., Detroit, Mich.

Fuel Sensitivity and Engine Severity in Aircraft Engines, by S. D. Heron, of Ethyl Corp., Detroit, Mich.

Utilization of the Exhaust Gas of Aircraft Engines, by Benjamin Pinkel, of National Advisory Committee for Aeronautics, Cleveland Airport, Cleveland, Ohio.

Friday afternoon, AIR TRANSPORT SESSION: Chairman, Jack Franklin, of Transcontinental & Western Air, Inc., Kansas City, Mo.

Evolution of the Modern Workhorse of the Airlines, by M. B. Bassett, of Glenn L. Martin Co., Baltimore, Md.

Some Requirements of a 'Feeder' Airplane, by J. G. Ray, Southwest Airways Co., Beverly Hills, Calif.

Friday evening, BANQUET SESSION: Chairman, R. D. Speas, of American Airlines, Inc., New York, and SAE Metropolitan Section.

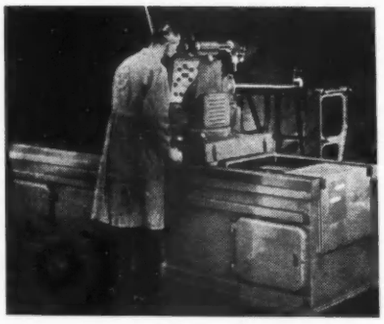
Address by SAE president, L. Ray Buckendale, of The Timken-Detroit Axle Co., Detroit.

Beyond the Slide Rule, by Gill Robb Wilson, of *The Herald-Tribune,* New York.

New Production Equipment

A TEMPLATE grinder with electronic control of wheel head axial traverse for the precise grinding of templates and other work up to 72 in. in length, 8 in. in depth, and 1 in. thick, without re-positioning is offered by the Sheffield Corp. of Dayton, Ohio.

The machine was originally designed for the specific purpose of grinding templates used in laying out and checking automobile body dies and the parts



Sheffield template grinder

produced with such dies. These templates are approximately ⅛ in. thick, and as many as eight can be ground at one time. Templates for many other types of profiles, including those encountered in aircraft fuselage and wing manufacture, can be made.

The Sheffield template grinder consists primarily of a base upon which wheel-head with control panel and optical equipment traverses, the electronic control unit and a work table with adjustable paralleled work supports. The work, with the desired profile scribed on it by either a scriber or by a photographic process, or with a master template mounted on top is clamped on the work table. The supporting parallels are adjusted to the rough outline of the work. The wheelhead is positioned on the transverse ways by the electronic controls so as to bring the wheel opposite the point where grinding is to start. Axial movement of the workhead may also be accomplished by turning the knurled knob to the left of the handwheel. The wheelhead may be adjusted on a turret to a maximum of 40 deg on each side of center so as to meet any conceivable requirement for positioning caused by shoulders and other irregularities of the profile to be ground.

The grinding wheel reciprocating slide is then properly positioned for the required stroke within a range of 0 to 1¼ in. The speed of reciprocation may be set at either 50 or 100 strokes per minute.

The wheel is brought in to the work by a manual cross slide feed hand wheel. Two ratios of cross feed (fast and slow) are provided. The operator views the work through a 20-power microscope in setting the wheel to the work, and in performing the grinding operation. He guides the microscope cross hairs along the lines of scribed work by means of cross slide handwheel as the wheelhead travels transversely.

A SPECIAL purpose machine utilizing five standard hydraulic power units and one lead screw tapping unit has been designed and built by LeMaire Tool & Mfg. Co., Dearborn, Mich.

It drills, reams, bores, counterbores, chamfers, and taps wheel cylinders all at one setting at a rate of approximately 840 pieces an hour.

By having all these operations performed while the part remains in fixed position in the fixture the manufacturer claims that greater accuracy in finished parts can be achieved.

Four parts are held at one time in each fixture by being clamped by air cylinder and are released by cam rail. Brackets mounted on each end of fixture contain two bushings which nest pins on bushing plates of drill units and head of tapping unit to assure positive alignment.

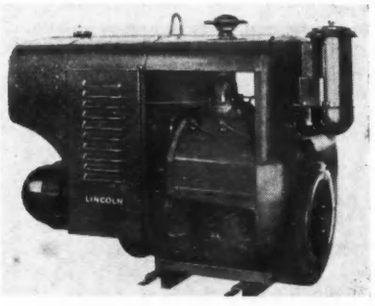
The machine itself is composed of five

LeMaire special purpose machine

LeMaire No. 2000 self-contained hydraulic drilling units and one LeMaire No. 150 lead screw tapping unit mounted at various angle on a fabricated base which supports a 7-station 54-in. diameter automatic index table. The cycle of operations is as follows: Station 1, loading and unloading; Station 5, drill deep holes; Station 6, combination counterbore and for 118 deg. seat; Station 7, tap.

A NEW portable welder of the gasoline engine-driven type is announced by the Lincoln Electric Co., Cleveland, Ohio. This 200-amp welder, known as the "Shield-Arc Jr.," is of compact design measuring 24 by 48 by 30 in. With a current range of from 40 to 250 amp, the machine can be used for the welding of light or heavy gage metal, for the repair of cast iron structures such as engine blocks, for the construction of various contrivances or the repair or fabrication of tools and machinery parts, and for hard facing of worn parts.

Provision is made on the output panel for three ranges of output current, continuous adjustment within these ranges



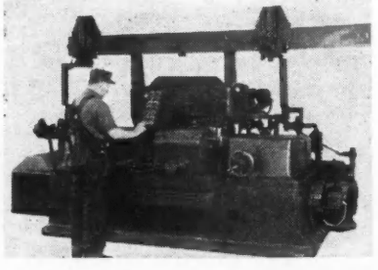
Lincoln 200-amp welder

being obtained by means of a simple speed control.

Generator controls are mounted inside an enclosed cabinet above the generator, cooling being through a fan mounted on the generator shaft.

The welder is powered by a Wisconsin air-cooled 4-cyl V-type engine. Shrouds around the engine fan and cylinders direct the cooling air. The speed of the engine determines the welding current which is controlled by adjusting the engine speed between a maximum of 2100 rpm and 1500 rpm (16 hp.)

WICKES BROTHERS, Saginaw, Mich., are manufacturing a new lathe, the combination Model CH-4 automatic rough and finish turning center drive crankshaft lathe. This machine is designed for all turning prior to hardening or finish grinding on all main line bearings and ends of automotive and similar crankshafts where production is high. The machine is equipped with



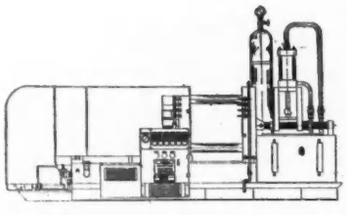
Wickes Model CH-4 crankshaft lathe

hydraulic feed and is completely automatic in operation, rough turning the main line bearings first with divided tools both front and rear and then automatically shifting the finishing tools into position and finish turning complete with divided tools both front and rear. Power operated loading and unloading device is provided. Machine is also equipped with synchronized variable speed and feed mechanism to maintain both the surface speed and tool feed at the maximum permissible throughout the entire cycle. The weight with electrical equipment is approximately 30,000 lb.

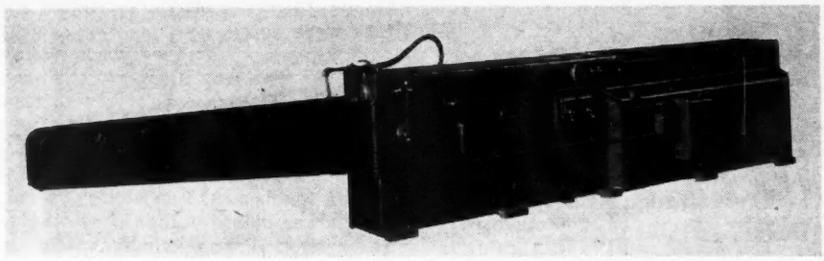
ELIMINATION of cold metal from the shot furnace, improved hydraulic performance, automatic timing and improved adjustable bearings for the movable platen are features of a die casting machine introduced by the Cleveland Automatic Machine Co., Cleveland, Ohio. The new machine, designated as Model 400, universal high-pressure hydraulic, is available for zinc, tin, lead casting or for magnesium, aluminum, bronze or brass.

Although the basic Cleveland design has not changed, including the interchangeability of hot metal ends, appearance of the machine is entirely different. All toggle and pump mechanism is entirely enclosed in steel guards which are removable to permit ready access to working parts.

A double-compartment furnace, on the zinc, tin-lead machine, with separate automatic burners for each compartment, does away with cold metal in the shot compartment. New metal is placed in the second compartment, automatically causing the overflow of readied molten metal into the shot section. Even temperature and uniform condition of the shot metal are maintained by this method.



Cleveland die casting machine

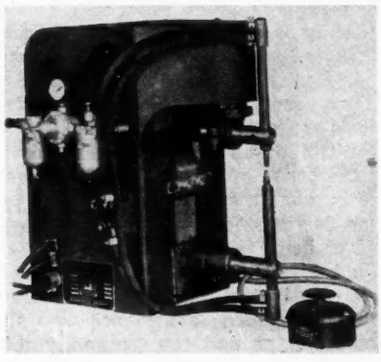


American horizontal broaching machine

THE American Broach and Machine Co., Ann Arbor, Mich., has brought out a new horizontal broaching machine in two models, the HD-15-66 and the HD-20-66. The Model HD-15-66 machine has a normal capacity of 15 tons and a maximum stroke of 66 in. The Model HD-20-66 has a normal capacity of 20 tons and a maximum stroke of 66 in.

This type machine is said to be especially suitable for heavy duty internal broaching operations, as well as many surface broaching applications. A feature is the new design incorporated in the machine bed. It has been past practice in the manufacture of horizontal broaching machines to use a single wall cast iron or steel fabricated bed. The type HD horizontal machine, however, has a rolled wall construction which, in effect, forms double walls throughout the bed and lends greater strength and rigidity to the base than can be obtained with the type of construction mentioned previously.

ADDED to the Universal line of 1 kva and 3 kva air operated midged bench-type spot welders made by Davis & Murphy, Chicago, Ill., is Universal USP-7½. It is a plug-in type and includes solenoid valve control of air cylinder, pressure switch and can be furnished with built-in NEMA 1 A electronic timer. It can also be furnished with NEMA 3 B or 5 B in separate timer panel. The solenoid valve control of air cylinder by adjustable pressure switch provides a wide range of uses for welding non-ferrous metals, and wire, and it will weld two pieces of 16-gage steel. The 7½ kva is equipped with air filter, pressure gage and automatic lubricator. Initiation of welding cycle is by electric foot switch. Transformer and electrodes are water cooled.



Universal bench-type spot welder

Measuring Labor's Productivity

(*Continued from page* 17)

appeared in the recent statement issued by Henry Ford II. He cited some specific increase in labor costs and said that, on an over-all basis, the Ford Motor Co. was getting about 34 per cent less output than it did in 1941 per direct labor manhour on comparable products and processes. This 34 per cent decrease in output per manhour from 1941 to 1945-46 so far, supports Matthew Smith, President of the Mechanics Educational Society, who stated in a *Detroit News* article published at the height of the war effort that Detroit factory workers were doing a third less than they could do in terms of normal, reasonable effort.

In this field, General Motors has made a somewhat more detailed check on many specific operations. It seemed of particular interest to determine what change in output per manhour had developed in a plant where there had been no change in the design of the civilian product, methods of manufacture, or the equipment used from 1941 to 1945, and where civilian production had been under way long enough in 1945 to become well grooved. It also seemed desirable to select a plant which had shown a tremendous increase in efficiency on war production. Other prerequisites for this study were complete records with unchanged occupational classifications, the same basis of wage payment (straight hourly rates), no change in the proportion of women in the labor force, and the same average hours per week in 1941 and in 1945.

The plant that best met these qualifications had made a heavy machine gun during the war. The price of this gun started out at about $350, reflecting the cost to an old-line firearm manufacturer. In December, 1941, after about a year's production experience with mass methods, the GM price was reduced to $140. When the contract ended in mid-1945, the GM price had been further reduced to $56. The plant had done no mean job of cost re-

duction in the face of increasing wage rates.

Prior to the war, this plant had been making a sub-assembly used on all GM cars and by other manufacturers. There was an active market for replacements and the plant got back into civilian production in mid-1945. Data are therefore available for a comparison between output per 1000 productive worker hours on these civilian items in December, 1941, and in October, 1945.

The following tabulation shows the per cent change in output per 1000 manhours of direct labor for the chief items manufactured:

Product	Per cent of Output in October, 1945, Compared with December, 1941
A	67
B	61
C	71
D	63
E	71
F	47
Weight average	63

In other words, for this GM plant, 1000 manhours of direct labor produced 63 per cent as much finished material in 1945 as it did in 1941, a 37 per cent decline in production. As previously noted, Henry Ford II had indicated a 34 per cent decline and Matthew Smith's estimate supported him.

The GM plant studied the records to find the cause of this productivity loss. Here is what they found:

One factor was less experienced productive help in 1945 than in 1941. While the 1945 worker had considerable experience in the plant, he had not acquired as much experience on the specific job as had the worker in December, 1941. By comparing production records of the more experienced with the less experienced, the plant found that seven percentage points of the total decline had resulted from the higher percentage of green help in the later period.

The second factor that could be estimated was the loss in productivity of direct labor resulting from poorer organization and tooling incident to less-experienced supervision and non-productive help. This accounted for another eight percentage points of the total decline. Just as the productive employes were less experienced on their immediate jobs of feeding the machines, handling the material, and assembling it, so were those who set up the tools and laid out production.

A third factor resulting in a one per cent decline, or perhaps a little more, was found to be interruptions in the flow of material. The plant did not have much trouble with material flow, but those interruptions which occurred wasted the time of the productive workers, and naturally resulted in loss in output.

These factors together represented 16 percentage points of the total decline of 37 per cent, leaving a 21 per cent loss which management believed was largely the result of reduced productive worker effort. On checking a number of other plants, similar declines were noted.

An example of lessened worker effort during the war may illustrate the problem. Cylinder castings for aircraft engines were made in the new aluminum foundry at Buick. A standard of 45 cores per eight-hour shift was set for two-men teams based on actual production in other plants and on time studies. But production was held down by the men to 22 cores per team, even though during the first few days of operation teams had produced over 30. The union demanded a change to day rate on this operation (an attempt to break the long-standing piece work system at the Buick foundry), arguing that the men could not get over 22 cores per day output. After a three-month slowdown, one or two teams became impatient with the low base earnings, broke the union-imposed ceiling, and produced 43 cores per day. Shortly thereafter, the plant was struck. Management discharged the two Shop Committeemen who were primarily responsible for the slowdown and strike. Within two days the strike was settled. Without any change in method, production immediately jumped to an average of 45 cores per shift. Within a few months, average production reached a level of between 80 and 90 cores: one team even maintained an average of over 120 cores for a period of one week before being inducted into the Army. Management faces a serious cost problem in the postwar period where it has failed to maintain standard of efficiency during the war. It may be worth mentioning one or two general problems in closing.

In order to achieve a high level of production and a maximum standard of living, it is important to give employment to the largest number of persons who are willing and able to do a day's work. But flat hourly wage rates and high employment are incompatible.

When persons of very limited capabilities are injected into a group paid a flat hourly rate, there is a very strong tendency for the group to reduce their output to the level of the slowest worker. Each individual feels he will cheat himself if he produces more than the minimum for the fixed pay per hour. For this reason, it is more economical to have four good men on a job than to have four good men and one slow man all working at the slow man's rate of production. High employment and high real wages can only be accomplished simultaneously if incentive wages make it possible to employ less efficient workers without slowing down the more able persons on the job. Incentive plans offer the only method through which wage increases can be made without raising costs and prices. However, most trade unions summarily reject the very means which would accomplish both these declared objectives.

In the past, an average annual increase of three per cent in manufacturing output per manhour has been a major factor in the improving American standard of living. However, this upward trend in productivity just does not happen automatically; it is quite conceivable that a lower level of worker effort could almost completely absorb any technical advance in the future as it has in civilian product industry during the war. Moreover, if the ability-to-pay formula becomes public policy in wage determination and the manufacturer is forced to give most of the savings from improved productive methods to the workers in terms of increased wage rates rather than passing part of the savings to consumers in reduced prices which induce increased sales, why make any further technical advances? Under those conditions, the standard of living for the nation would no longer advance.

Management and labor both must realize that increased economic improvement for the underprivileged is contingent upon continual increases in productivity. Only by working together and reducing the area of conflict, can this be accomplished.

Charts prepared by the United States Department of Labor show that productivity in 24 civilian goods industries was about 15 per cent below normal in 1944 because of failure to make gains during the war. The 30 per cent gain in productivity from the present to 1950 would just about bring the nation back to a normal trend. In other words, American industry must gain six or seven per cent a year for the next four years even to get back to normal in 1950. It is going to take hard work and the cooperation of everybody.

Gas Turbine Engine Program at Menasco

A gas turbine engine program has been undertaken ranging from horsepower output suitable for largest commercial aircraft down to personal airplanes, and in the automotive, marine and trucking fields, according to John C. Lee, president, Menasco Manufacturing Co. Lee revealed a wide scope of activities for the concern during 1946. This expanded program was made possible by acquisition of manufacturing rights, all gas turbine engines and engineering personnel from Lockheed Aircraft Co. The two companies have been working for more than two years on this advanced jet design.

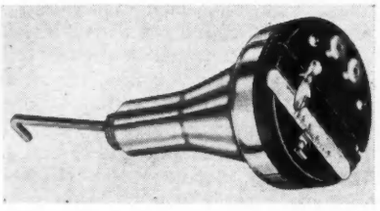
Menasco's activities will include increased work on landing gear for both commercial and personal airplanes. A national marketing program has been launched for Malabar jack products and a small washing machine being produced at an estimated rate of 100,000 units annually. Experimental engineering in small lightweight gasoline engines for industrial use is under way. Tests have also been carried on for the past two years on a 15-hp Diesel engine.

New Products for Aircraft

Piston Position Indicator For Aircraft Engines

Precision engine timing by direct measurement of piston travel is provided by the new Model B Time Rite designed by the Gabb Manufacturing Co., East Hartford, Conn., for use on all aircraft engines for all timing operations.

The features of the Time Rite design



Model B Time Rite piston position indicator

—a slide pointer, automatically referenced, and an adjustable calibrated scale—are said to eliminate the need for finding top dead center and compensate for the variables involved in accurate piston positioning. In addition to location of timing positions, either before or after top dead center, the Time Rite may be used for magneto point synchronization.

The complete Time Rite indicator kit includes carrying case, supplemental battery supply, battery leads, magneto synchronizing leads, and instruction book. Calibrated scales are available for all type engines.

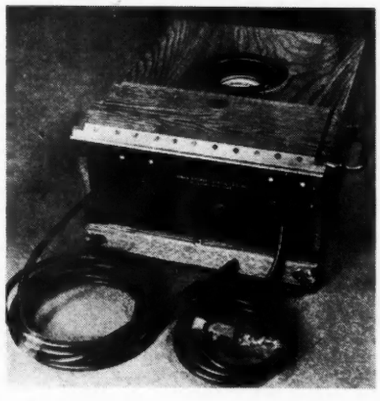
New Continental Nine-Cyl Radial Air-Cooled Engine

Continental Motors Corp. has started production of a nine-cyl radial air-cooled airplane engine for post-war executive type and medium size transport planes to be manufactured by Beech Aircraft Corp. and the Lockheed Aircraft Corp. It is an improved version of the R-975 450-hp radial engine which Continental built during the war years to power medium (30-ton) tanks, amphibious tanks and Hellcat tank destroyers. Power output and other performance characteristics are said to have been greatly improved for airplane use.

The new engine has a take-off rating of 525 hp with a direct drive and 600 hp with a geared drive. The planes which it will power will carry from six to 14 passengers.

Tester for Locating Ignition Difficulties

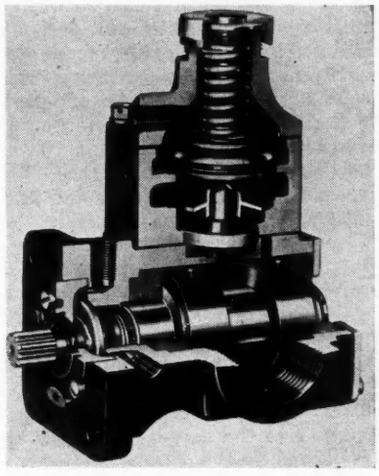
An ignition harness tester for locating ignition difficulties on aircraft engines has been brought out by Goble Aircraft Specialties, Inc., Flushing, N. Y. It locates electrical troubles such as: leakage past cable insulation, leakage on distributor blocks or fingers, or excessive electrical leakage due to moisture in spark plug wells or on terminal sleeves.



Globe ignition harness tester

To use this tester, it is only necessary to disconnect all spark plug elbows and then proceed to check out the ignition system. The dial on the fact of the tester will indicate the condition of the part being tested. It will be either good or bad.

Twin-Valve Pump



This Titan Dualvalve pump, developed by the Chandler-Hill Corp., Detroit, Mich., delivers a constant flow of fuel at almost constant pressure. It incorporates two relief valves which, working on a common guide pin, balance each other and make possible extremely close pressure regulation. The new pump is made in two models with respective capacities of 830 and 1,600 gallons per hour at 2,500 rpm.

British Build Solent for Overseas Service

A new airliner, the Solent, developed from the Short Seaford military flying boat, with an operating range which brings the North Atlantic route within its compass, is being built for British overseas air service. Twelve have been ordered and the first will be completed in about four months' time.

The estimated gross weight of the Solent is 75,000 lb, but this is likely to be increased. There is accommodation for 24 passengers day-and-night, or 36 day passengers. The six cabins, four of which are on the lower deck and two on the upper deck, can each carry six day passengers or four night passengers. When 24 day-and-night passengers are carried, the cabins on the upper deck are used as a lounge and dining room. The crew of five consists of two pilots, navigator, radio officer and flight engineer. There is also accommodation for two stewards.

More than three feet longer than the Sunderland, the Solent is 89.54 ft in length, has a span of 112.8 ft, a height of 37 ft and maximum beam of 10.8 ft. Wing area is 1687 sq ft, wing loading 44.5 lb psf, and aspect ratio 7.53 to 1.

Powered by four Bristol Hercules 130 air-cooled radial engines, having 1675 hp per engine for take-off, the Solent has a maximum speed of 236 mph at 7000 ft.

Surplus Airplane Engines For Electric Powerplants

Following the pattern at the end of World War I, several companies are experimenting with the possibility of adapting surplus radial aircraft engines for gas-electric powerplants. Reports received recently indicate that attempts are being made to develop generator sets in ratings from 75 kw and upwards. Thus far this work is purely experimental and not in the category of commercial applications.

White Hydro Torque Transmission

(*Continued from page* 20)

Gear h is mounted on an extension of the counter shaft which is always driven in proportion to the turbine speed. The upper differential pinion, therefore, rotates at a speed in proportion to the speed difference between the engine and the turbine and drives the differential governor by means of a square key. The differential governor contains two different series of weights, which actuate two switches in the upper part of the governor through the governor riser. The switches are of the over-center spring arrangement, giving positive action without hunting. The one switch makes contact when the speed difference becomes a certain minimum and thereby starts the up-shift cycle. The other switch makes contact when the speed difference becomes a certain maximum, inaugurating the down-shift cycle.

This differential control imparts flexibility to the drive. Since the shift is governed by the torque requirements, it is possible to shift into high gear at low speeds and low torque requirements at extremely low speeds, thereby making it possible to save fuel, inasmuch as the engine speed under these conditions will be lower than it would be if the transmission would stay in low gear at this time. On the other hand, at full throttle the transmission will stay in low gear to give maximum acceleration.

The up-shift and down-shift cycles are essentially the same as the shifts on a mechanical transmission except that no clutch is being actuated. Instead, the engine speed is manipulated to give proper synchronization. After the differential governor gives the signal for the up-shift, the engine speed is decreased by closing the carburetor automatically, thereby causing a torque reversal in the driving connection of the low gear while at the same time air pressure is admitted to the shift piston in the transmission cover forcing the shift collar from low to high. After establishing synchronization, the shift is completed and the carburetor butterfly opens automatically, permitting the engine to pick up speed consistent with the accelerator position. No reaction is felt on the accelerator pedal.

The down-shift cycle proceeds in the same manner as the down-shift on a standard transmission, including double clutching. After the differential governor gives the down signal by closing the down switch, the butterfly momentarily closes again, causing a torque reversal in the driving connection of the high gear. At the same time, air pressure to the shift piston is shut off, allowing the spring to move the shift piston toward low gear. After disengagement of the synchromesh collar from the main drive gear, the butterfly opens automatically to speed up the engine and relieve the synchromesh unit of as much work as possible. The engine then speeds up until synchronization has been established, at which time the ignition is broken so that the final engagement to low gear is made with the engine torque momentarily interrupted. After completing the engagement to low, ignition is restored and the engine speeds up in accordance with the prevailing accelerator pedal position. Again in this case there is no reaction on the accelerator pedal. A down-shift can also be inaugurated through the low speed governor when the vehicle is below a certain minimum speed.

In order to prevent the transmission from hunting, the low-speed governor, which is mounted at the rear of the transmission and returns it to low gear below a certain vehicle speed, contains a switch which makes the up-shift speed controlled after a power down-shift has occurred. Besides preventing the hunting of the transmission, this has the advantage of giving the driver a means of staying in low gear irrespective of torque requirements. Furthermore, when descending a hill, where the vehicle is driving the engine, this feature is utilized to retain the transmission in low gear. During this phase, the vehicle becomes the driver and the power is transmitted to the turbine wheel of the converter and from there to the pump, thereby driving the engine. Since the vanes of the wheels have not been designed for efficient power transmission in this direction, the efficiency is lower than when transmitting power in the other direction.

Several advantages are thereby derived. First, due to this lower efficiency, it is not possible to establish the minimum speed difference required for an up-shift and the transmission will stay in low gear irrespective of the speed of the vehicle. In order to get out of low gear, the driver follows his natural impulse and steps on the accelerator, speeding up the engine and bringing the engine speed up to and beyond the turbine speed, thereby creating the minimum speed difference and causing an up-shift to occur. The other advantage is that in order to drive the engine, some power must be transmitted through the converter. The transmission of power in this direction is inefficient, causing some loss of this power in the hydraulic unit, giving the vehicle an increased braking effect. The third advantage is that due to this loss of power, the engine speed will never be as high as it would be in a mechanical transmission, thus extending engine life.

Fig. 5 shows the increase in efficiency and torque obtained by combining the hydraulic torque converter and hydraulic coupling with a two-speed gear box. This increase is represented by the area between the efficiency curve shown in full up to 25 mph, and the efficiency curve shown in dotted lines. The latter representing the efficiency which would prevail in high gear if a converter without a gear box would be used. Similarly the torque ratio increase is shown by the area of the torque ratio curve up to 25 mph, and the dotted torque ratio curve which again represents the torque ratio that would prevail in a drive without a two speed gear box. Furthermore, the efficiency curves show the ranges in which the drive operates as a hydraulic coupling and a hydraulic torque converter; and they show that the characteristics and flexibility of the torque converter are available in both speed ranges.

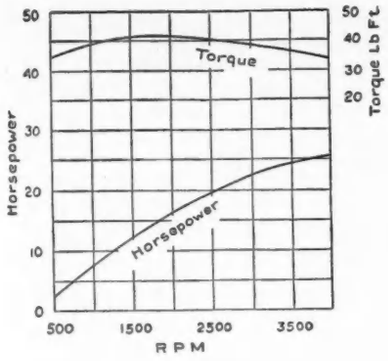
The Bobbi Kar

(*Continued from page* 37)

is possible to remove the entire power unit from the automobile in a matter of minutes. This feature is predicated for the most part upon abnormal conditions existing in some of the outlying export fields. It is considered, by the manufacturer, entirely feasible and practical for a dealer to stock replacement or rental units for fast and expedient servicing under almost any condition.

Care has been taken throughout the mechanical design of the car to utilize to the greatest extent standard parts and equipment items. For example: transmission, clutch, differential, brakes, steering gear, engine, etc., may be replaced with items manufactured in large volume over a long period of years by some of the outstanding automotive equipment manufacturers in this country. In short, the mechanical design is said to be the result of careful selecting and combining of standard proven units.

Much research was made in the early development stages into the possibilities of producing these cars with plastic bodies. Various types of materials impregnated with resins were studied. Invariable the answers were found to be the same. For example, fibre glass cloth, plastic impregnated, and molded to the desired shapes, produced finished body panels that were highly desirable from the standpoint of weight, strength, finish and durability. However, the basic material costs and the manufacturing methods required to produce these bodies were found to be prohibitive for large production quantities. Consequently, it became necessary to revert to the standard practice of steel body fabrication. The convertible coupe top, however, was left as a plastic item, both because of the desirability for lightness from a handling and stowing standpoint, and also due to the fact that it is an ideal shape on which to realize



Power curves of the Hercules engine without accessories

maximum plastic forming efficiency.

Outer body panels are mounted on the inner structural body in such a way that they may be easily removed for repair or replacement in event of damage. All body panels are relatively simple shapes for fabrication and forming. The rough stamping of the dashboard has been covered with foam rubber padding, and a leather exterior. This process of covering a rough stamping requiring no further treatment or clean-up has proven less expensive than applying excessive trim, decals, graining, etc. Interior furnishings feature leather-type upholstery. A choice of colors to match or contrast with exterior finish will be available.

Wartime Developments

(*Continued from page* 35)

W. M. Chace Co. highspotted its offerings of thermostatic bi-metals and actuating elements for temperature responsive devices. The Drop Forging Institute had an impressive display showing the range of forgings in size and complexity, the types of dies commonly used, and macro-etched sections of forgings to show the fiber-like flow line structure of a good forging.

PRECISION CASTINGS: All of the manufacturers mentioned here, except the nonferrous division of Briggs Mfg. Co., use the so-called "lost wax" process. At least one of the major producers has found a way to salvage almost 90 per cent of the special wax used. In that case, therefore, it is really no longer a "lost wax" process. Perhaps it might be better called a plaster or ceramic process.

Although there are many claims for this precision casting technique, the following brief list gives some of the most prominent:

1. Assurance of close tolerances.
2. Development of perfectly smooth surfaces.
3. Production of intricate shapes difficult to make otherwise.
4. Production of parts from non-machinable alloys.
5. Low tooling cost for moderate volume.

The manufacturers exhibiting in this group included—Bergen Precision Castings, Inc., Trifari, Krussman and Fishel, Inc., Michigan Steel Casting Co., The Kerr Dental Mfg. Co., J. R. Wood Products Corp., Austenal Laboratories, Inc., and Briggs Mfg. Co. The manufacturers using the wax technique follow rather similar basic procedures, except for special operations developed by each one. There are two basic methods in current use—investment in plaster and investment in abrasive, together with the variation practiced by Michigan Steel Casting Co., where both abrasive and plaster are used. Consider a typical procedure employed by the Austenol Laboratories:

1. Preparation of a metal pattern.
2. Preparation of a soft metal mold from the pattern.
3. Casting of wax forms in the mold.
4. Gating and sprueing of wax forms.
5. Investment of wax trees in a special refractory.
6. Heating of the refractory mold to melt wax.
7. Pouring metal under pressure into mold.

This process is used for producing castings of ferrous metals as well as of non-machinable hard alloys of various kinds.

The Michigan Steel Casting Co. procedure marks a variation of the one given above and is used in the production of small, intricate steel castings:

1. Preparation of a metal mold for wax.
2. Wax forced into mold under pressure to produce forms.
3. Building up of wax trees—gates and sprues.
4. Dipping of wax trees in liquid ceramic composition.
5. Investment of coated trees in plaster and heating to harden.
6. Heating of plaster mold at higher temperature to melt wax.
7. Pouring of metal into cavity formed by the ceramic matrix.

Others use the method of "lost" wax invested in a plaster mold with variations developed by each one. For example, J. R. Wood Products Corp. spins the mold instead of pouring metal under pressure.

Briggs Mfg. Co. relies entirely upon the recently developed method of plaster molding, using special plaster formulations, and works exclusively with non-ferrous metals. The process entails considerable skill but is simple enough to describe. Essentially, Briggs first makes a metal pattern, much like a match-plate containing a large number of related parts. This pattern then is bedded in a plaster mold and carefully removed after the mold has hardened. The mold is of the conventional cope and drag type into which the metal is poured.

ENGINEERING MATERIALS — FERROUS AND NON-FERROUS: Judging by what was seen, industry can look to the availability of the gamut of materials from which it was cut off by the war shortages. One of the technical papers dealt with the valuable properties of boron as an additive or "needling" element capable of imparting to carbon steels many of the properties of low alloy steels. Vanadium Corp. of America reminded metallurgists of its Grainal alloys as an economical means of controlling and increasing the capacity of steels to harden; also Graphidox No. 4, an alloy for the graphitization of cast iron.

Among the non-ferrous producers there were impressive displays by the Aluminum Co. of America, Reynolds Metals Co., and Dow Chemical Co., to illustrate the useful applications of aluminum and magnesium in its various forms for automotive products. Ampco Metal, Inc., exhibited a complete line of its bronze alloys in sand and centrifugal castings, welding electrodes, and safety tools of beryllium copper, aluminum bronze, and monel.

Beryllium alloys and products were represented by the Beryllium Corp., Brush Beryllium Co., and others, including the Akron Bronze & Aluminum Co., suppliers of Viculoy beryllium copper castings.

Agaloy Tubing Co., showed its tubing specialty in various forms—seamless, welded, spiral brazed, and in forms fabricated from sheet stock and spirally wound. Joseph T. Ryerson & Son, Inc., reminded visitors of the addition of Nitralloy to its line of warehouse materials. Great Lakes Steel Corp., announced the availability for commercial use of its "extra-high-strength" sheets and plates developed and used during the war.

New Jersey Zinc Co., prime suppliers of Horse Head zinc alloys of high purity for automotive die castings, had an extensive exhibit of die castings developed for postwar use, including some of the sections for the Cadillac grille which are said to be the largest castings of their kind.

Allegheny-Ludlum Steel Corp.—tool steels, stainless and electrical steels, and Carmet; Carpenter Steel Co.—new air-hardening steel, Carpenter free machining stainless steel, and other special materials; Haynes Stellite Co.—with its line of new high temperature alloys, a precision casting process for producing parts from its hard alloys such as Haynes Stellite, standard cutting tools; International Nickel Co.—an impressive exhibit of parts made of wrought steels, nickel cast iron, Ni-Resist, Ni-Hard, Monel, Inconel, Invar, and other special alloys; Lukens Steel Co. and its subsidiaries By-Products Steel Corp., and Lukenweld Inc.—plate and heavy-duty weldments such as large Diesel engine cylinder blocks; Molybdenum Corp. of America—tungsten, molybdenum, boron, and nickel oxide products; Rustless Iron and Steel Div., American Rolling Mills; S. K. Wellman Co.—clutch facings and brake linings made from powdered metal; and many others.

QUALITY CONTROL — GAGES AND INSTRUMENTS: Only a short time ago many of the electronic devices for the non-destructive examination of metals were purely laboratory instru-

ments. But during the war years, these valuable instruments, including equipment for supersonic setting — a top secret during the war — were made available for mass production inspection. A sampling of these devices is given in this section.

Stemming from the Cystoscope, used by surgeons for internal examination, the American Cystoscope Makers, Inc., have introduced the Wappler Borescope, an ingenious optical instrument for the inspection of internal surfaces, particularly long, slender bores.

The Brush Development Co., producers of the Brush surface analyzer for measuring the roughness of surface finishes, has introduced the Hypersonic analyzer for the detection of internal flaws in solids by means of sound waves. A production application for scanning in continuous strip mill operation was shown. Sperry Products, Inc., announced its Supersonic Reflectoscope, an instrument for detecting flaws by means of high speed sound reflection in solids up to 10 feet in length, giving the exact position of the defects.

An electronic method of non-destructive examination of magnetic or non-magnetic materials, providing a variety of metallurgical examinations in production, is found in the Cyclograph, exhibited by the Allen B. DuMont Laboratories, Inc. This instrument is used as a comparator, comparing a master sample against production parts. Federal Products Corp. — a line of Federal Foote-Pierson electronic gages, Federal Metricator air gages, and the well known line of indicator dial gages. Magnaflux Corp.—its famous line of equipment, including the new automatic unit for parts production, a new machine for use in foundries, an automatic Zyglo unit for non-metallic parts inspection, and demonstrations of Stresscoat. Magnetic Analysis Corp.—a line of equipment for production inspection of steel bars and tubing, and special magnetic comparators for sorting various ferrous parts and materials. North American Philips Co.—Norelco X-Ray diffraction apparatus for the identification, comparison, and analysis of materials, and the electronic Searchray Model 150, a complete industrial X-ray unit for the internal inspection of parts and castings.

Physicists Research Co.—latest line of the famous Profilometer instruments for the production measurement of surface roughness.

Control Equipment Co. offers the portable Metalsorter with electronic timing control for the non-destructive identification of pure metals, steels, and non-ferrous alloys. The Compa-Instrument Co. showed its Comparascope, an optical comparator for tool rooms and in the shop; American Measuring Instruments Co. announced the Amic line of precision measuring instruments—the Amic comparator and the Amic Opto-Indicator, and optical indicating gage. Elgin National Watch Co. exhibited a line of sapphire plug gages and ring gages, and standard sapphire shapes produced by its sapphire division.

INDUCTION HEATING AND HARDENING: Induction heating, particularly with the application of electronic methods has progressed by leaps and bounds with a variety of machines for heating, hardening — internal and external, brazing, etc. Among the specialists in this field are: Allis-Chalmers Mfg. Co.; Budd Wheel Co., with its equipment for the internal hardening of automotive parts; Federal Electric Co., Inc.; Induction Heating Corp.; Ohio Crankshaft Co., the leading producer of induction heating and hardening equipment for the automotive industry; Sherman & Co., induction silver brazing.

HEAT TREATING—EQUIPMENT AND MATERIALS: This field abounds in new ovens and furnaces, in advanced processes, and in new materials for carburizing, hardening, and quenching. Among the exhibits in this category were the following: American Cyanamid & Chemical Corp., with its new Iso-Thermo heat treating process; Bryant Heater Co.—new industrial gas combustion equipment; Despatch Oven Co. —convection heating ovens of new type; Hevi Duty Electric Co.—electric furnaces for industrial and laboratory use; E. F. Houghton & Co.—new Martemp oil for oil quenching in the Martempering process, a material having high flash and fire characteristics. Its chief advantage is claimed to be freedom from distortion of work of irregular size and shape without the use of quenching fixtures. Houghton also revealed a new method of rectifying salt baths for the heat treating of tool steels, the use of a special carbon rod in barium chloride baths.

Lindberg Engineering Co. — a new roller hearth brazing furnace with neutral atmosphere of the type installed by Crosley for the hydrogen brazing of the entire steel cylinder block of the Crosley engine which was described in this publication recently.

Selas Corp. of America — producers of special heat treating equipment designed for installation directly into a production line as if it were a metal cutting machine. Stainless Surface Hardening Co.—useful applications of treating stainless steel parts. The Lithium Co.—lithium metallic vapor furnaces; Gas Appliance Service, Inc.—manufacturers of special machines of turntable type for mass production of small parts; The Lakeside Steel Improvement Co.—steel treating service including, Martempering, Aerocasing, Chapmanizing, etc.; Tempil Corp.—a new line of Tempil products in pellet and stick form for signalling temperatures of various ranges.

CHEMICALS—PLATING, CLEANING, COATING: Detrex Corp.—a line of solvent vapor degreasing machines, automatic spray washers, and solvents and compounds for metal cleaning; DuPont — new sodium hydride descaling process for mass production; E. F. Houghton & Co.—cleaning compounds, and a new Cosmoline compound for protecting machined parts from corrosion and finger prints; Kolene Corp.—

Antiknock Value of Gasoline

(*Continued from page* 34)

that an increase in intake air temperature may increase, decrease or have no effect on knock in a given engine, depending on where the spark is set. For example, in one engine (Fig. 6) setting the spark for borderline knock with a 70 octane number reference fuel at 1000 rpm resulted in no appreciable change in knock when the intake air was raised from 100F to 175F, or to 225F. However, with the spark advanced to give borderline knock with an 85 octane number reference fuel, raising the intake air temperature from 100F decreased the knock and at 225F an 80 instead of 85 octane number reference fuel gave borderline knock at the same spark setting. When the spark was retarded for borderline knock with reference fuels lower than 70 octane number, the increased air temperature increased the knock slightly.

With another engine at 1000 rpm (Fig. 7) with the spark set to give borderline knock on an 80 or 85 octane number reference fuel an increase in an intake temperature did not affect knock. However, with the spark retarded to give borderline knock on a 65 octane number reference fuel at 100F air intake temperature, the knock increased at the higher temperatures and at 225F a 75 octane number reference fuel was required instead of the 65 octane number fuel for borderline knock. In some engines, as illustrated in Fig. 8, the effect of raising intake air temperature on knock was negligible throughout the range of spark timing investigated.

Although reference fuels have been used for the examples cited, it was found that the test fuels used reacted to changes in intake air temperatures in a manner quite similar to the reference fuels. The curves presented herewith are not necessarily representative of normal fuels and engines and were chosen to illustrate the fact that laboratory octane numbers are not always reliable indices of the true anti-knock value of a fuel. However, due to the increased number of processes developed during the war for refining fuels and to the changes in motor engine design which will undoubtedly take place to make the best use of these fuels, it is quite possible that instances such as those illustrated will become common.

new process for economically preparing cast iron and steel for plating and tinning; Oakite Products Inc.—a line of metal cleaners and demonstration of a new Oakite-Vapor heavy duty portable cleaning unit; Solventol Chemical Products, Inc. — multiple phase cleaners, cleaning compounds, and an automatic spray washing machine; Standard Steel Spring Co., demonstrating radiant burner heating applied to the Corronizing process; Vapor Blast Mfg. Co.—vapor blast honing process for cleaning of finely finished metal parts; a method used widely during the war on aircraft parts; the Rustless blackening process for finishing stainless steels, developed by the Rustless Iron and Steel Corp. during the war.

SPECIAL CUTTING TOOLS: This classification includes the various grades of cemented carbides, special hard alloys, and special tools of various kinds.

Carboloy Co.—cemented carbide tips and tools and drawing dies; Fansteel Metallurgical Corp., and Vascoloy-Ramet Corp.—carbide tools and dies, Tantung special shapes and castings, electrical contact points; Firth-Sterling Co.—carbide tools and high speed steel tools; Haynes Stellite Co.—special hard materials such as Haynes Steelite, Hascrome, and Hastelloy; Jessop Steel Co.; Kennametal, Inc. — carbide tools and wear-resistant parts; Vanadium-Alloys Steel Co.

CUTTING OILS: Industry recognizes the vital role played by cutting oils in the economy of metal cutting. A variety of proprietary materials are available from the leading producers some of whom are mentioned briefly below: Cities Service Oil Co.; E. F. Houghton & Co.; D. A. Stuart Oil Co., Ltd., which exhibited a varied line of difficult machining jobs for comparison; Sun Oil Co.; Texas Co.; Tide Water Associated Oil Co.

MATERIALS HANDLING: In this group are included the exhibitors of materials handling equipment—conveyors and industrial trucks.

Alvey-Ferguson Co. — producers of gravity roller conveyor systems; Automatic Transportation Co.—a wide line of electric industrial trucks and hand trucks; Baker-Raulang Co.—a line of fork trucks, locomotive cranes, and industrial trucks; Barrett-Cravens Co.—electric and hand lift trucks, skids and elevators; Lewis-Shepard Products, Inc.—variety of industrial trucks; Towmotor Corp. — power driven industrial trucks; Yale & Towne Mfg. Co.—industrial trucks; The Rapids-Standard Co., Inc.—the improved "Press-Veyor" a compact, portable conveyor for press shops, and a line of gravity roller conveyors.

MISCELLANEOUS METAL WORKING EQUIPMENT: Lester-Phoenix, Inc.—a new line of injection molding machines for plastics made in seven sizes; also die casting machines of cold chamber injection type for aluminum, brass, and magnesium; Kux Machine Co. — special molding machines for forming powdered metal parts.

The Thomas metal disintegrator for salvaging operations as well as for cutting extremely hard metals was displayed by the Clinton Machine Co. East Shore Machine Products Co. had a line of Glenny adjustable expansion push broaches. Black Industries demonstrated the drilling of hard steels and other metals with the Black drill. The Denison Engineering Co. showed a wide line of special HydrOILic Multi-Units unique unit type equipment for performing a variety of multiple operations for mass production. Republic Drill and Tool Co. demonstrated the new principle of Hyper-Drilling with the jet type drill.

Air Reduction Sales Co. showed its complete line of Airco oxy-acetylene cutting machines, the Radiagraph and Planograph, as well as the new Airco electronic "bloodhound" tracing device for machine gas cutting. Aro Equipment Corp. had its line of portable rotary pneumatic tools so widely used in the automotive industry. Andrew C. Campbell Div., American Chain & Cable Co., Inc., exhibited its well-known automatic abrasive cutting machines. Cleveland Pneumatic Tool Co. showed pneumatic drills, hammers, riveters, and other items. Delta Mfg. Co. displayed its bench-type drills and grinders. DeWalt Products Corp. — high speed dry cutter for light metals, and a heavy-duty wet cutting machine; Do-All Co.—a complete line of production and tool room equipment including the new Zephyr friction sawing machine and Zephyr high-speed sawing machines;

Independent Pneumatic Tool Co.—Thor portable electric and pneumatic tools; Porter-Cable Machine Co.—wet belt grinders, and automatic feed table; Sav-Way Industries—injection molding machine, Sara-Seal heat sealer for plastics, internal grinders; South Bend Lathe Works; Wells Mfg. Corp.—horizontal and vertical metal cutting band saws.

WELDING EQUIPMENT: P. R. Mallory & Co.—welding electrodes and tools made of Elkaloy, Elkonite, and Mallory metal; Eutectic Welding Alloys Co.—rods and fluxes for Eutectic low temperature welding and brazing; Sciaky Bros.—a full line of the well-known resistance welding machines—spot welders, projection welders, portable spot welders, seam welders, flash welders, press-type welders.

PHYSICAL TESTING EQUIPMENT: Krouse Testing Machine Co.—fatigue testing equipment—direct repeated stress, high-speed rotating beam machine, bending machine, universal fatigue testing machine, spring testing machine; Tinius Olsen Testing Machine Co.—various types of test equipment including the new electro-mechanical universal testing machine of 20,000 lb capacity with electronic high magnification recorder; Riehle Testing Machine Div. — 30,000 lb precision hydraulic universal testing machine, stress-strain recorder, impact tester.

Bonded Brake Linings on Dodge Half-Ton Trucks

Bonded brake linings with increased braking area have been announced as standard equipment on the half-ton series of Dodge trucks. The linings are bonded to the shoes by the Cycle-Weld process which was developed by S. Gordon Saunders, research expert of Chrysler Corp. The process derives its name from the fact that it requires a cycle of pressure and heat to produce a bond. The weld is said to withstand a separation pressure far in excess of the strength of the brake lining itself.

In the process of applying the new lining, the outer surface of the brake shoe is sand-blasted to remove scale. This provided a better surface for adherence of the Cycle-Weld cement. Then the Cycle-Weld cement is sprayed on the steel shoe. After drying slightly, the lining is applied and the metal shoe, with lining attached, is placed in a clamping fixture.

It remains in the metal fixture while the adhesive is dried in an oven at 350 F. Then the clamping fixture is removed and the bonded lining and brake shoe are ready for use.

Detroit May Have Automobile Show

Detroit may have an automobile show to introduce 1947 models. The Detroit Automobile Dealers' Assn. is exploring the possibilities of re-establishing the annual event, which it sponsored before the war. A committee is investigating manufacturers' plans to see whether such a show would be practical this year.

Raskob Resigns

John J. Raskob has resigned his positions as a director and vice president of E. I. du Pont de Nemours & Co., thus terminating a connection with the organization that had endured since 1902. J. Warren Kinsman, general manager of the Fabrics and Finishes Department of the Du Pont Company, was elected by the board of directors as a director to succeed Mr. Raskob.

Standard Oil Consolidates Two Engineering Departments

Standard Oil Development Co., central technical organization of Standard Oil Co. (New Jersey), has consolidated its two engineering departments.

The consolidation brings into one organization more than 400 scientists and other employees of the General Engineering Department and the Process Engineering Department which have operated independently for nearly 10 years. The new organization, named the Esso Engineering Department, is directed by E. W. Luster, chief engineer, who reports to Dr. N. E. Loomis, vice president in charge of engineering.

Expansion of Manufacturing Facilities at Nash

(*Continued from page* 30)

is mounted in a suitable fixture and has assembled to it a group of brackets and detail small parts. Following arc welding the assembly is loaded on a conveyor, first for Bonderizing, then prime paint. It is then ready for the suspension assembly line.

The other major stamped elements of the suspension assembly are the upper and lower control arms, the latter being an extremely difficult stamping because of its size and gage. The lower control arm is produced from a steel blank 18 in. by 22¾ in. in size, of 0.1046 in. thickness. The operations required to produce the piece are as follows:

1. Blank on a Toledo press.
2. First and second breakdown in a two-stage die on a Toledo press.
3. First form, first pierce, finish form, trim flange on a Bliss press.
4. Pierce holes in outer flange—four passes on a Toledo press.

The stamping then is fitted with spacers which are pressed in with a Toledo press, welded in place in Acro projection welders, to make up the lower control arm and bearings assembly. Latest piece of equipment for machining the lower control arm is an enormous two-way Greenlee horizontal special purpose machine with a three station drum type fixture, taking three pieces at a time. It handles the drilling and reaming of the bearing diameters from opposite ends.

Now the scene shifts to the adjacent machine shop for some noteworthy metal cutting operations on a number of the forgings and stampings comprising the suspension assembly. The pictorial sections shows the large double-end W. F. & John Barnes machine used for rough-reaming and finish-reaming the two bores in the upper control arm stamping. Operations on the steering knuckle are interesting and are given in detail on the routing reproduced elsewhere in the article.

Next item is the steering arm forging. Following forge shop operations, heat treatment, and Tumblasting in an American Wheelabrator, the bosses are straddle-milled in a Cincinnati Duplex mill. Then two holes are drilled, reamed, and burred in a Natco multiple spindle drill press. The LeMaire special multiple spindle, four-station machine, illustrated in the pictorial section, is used for the drilling, rough-and finish-reaming of the tapered bore.

Another interesting machine is the big W. F. & John Barnes five-station unit for drilling, reaming, rough-and finish-facing of the steering knuckle pin. Other operations performed on this part are shown on the routing.

Some new equipment is in evidence for the forgings in the Ambassador suspension system. Most outstanding is the huge three-way Greenlee for the steering knuckle support arm. This machine has a four-station-square center fixture—taking two arms on each face. It handles the drilling, reaming, and tapping of both ends with tools coming in from the two end stations. The king pin holes are reamed with long bars coming in from the rear station.

Upon completion of machining operations, the parts of the suspension system are transported to the assembly conveyor. An important step here is the measurement to determine the exact number of standard shims required in the connection of the steering knuckle pin and the upper control arm. This is done by installing a standard thick spacer, then loading the assembly by air pressure to measure the end-play. The amount of clearance is read off on the scale of the dial gage and determines the number of shims to be installed on the line. This fixture has removed all guesswork and cut-and-try.

As the unit is built up on the line, the upper and lower control arms are compressed together by means of pneumatic fixtures or presses on each side to compress the coil spring, thus to facilitate installation in the chassis. After the elements have been compressed, they are held together with special clips which remain in place until installation has been made on the final line.

At this stage we reach the final assembly division, which has two major final assembly lines—one for the "600", the other for the Ambassador. In turn, each one has its own axle and front suspension assembly lines, its own body assembly, chassis assembly, and final OK lines. The following tabulation gives the identification and full length of each of the conveyors.

TABLE I—"600" Conveyor System

Front suspension assembly line	79 ft 6 in.
Motor unloading conveyor	35 ft 6 in.
Rear axle assembly conveyor	96 ft
Torque tube conveyor	54 ft
Body assembly line	456 ft
Merry-go-round	144 ft
Chassis line	402 ft 6 in.
Final line	346 ft
Final OK line	295 ft 6 in.

TABLE II—Ambassador Conveyor System

Motor unloading conveyor	41 ft 6 in.
Rear axle assembly line	103 ft
Front axle suspension assembly	46 ft 2 in.
Frame assembly conveyor	175 ft
Body assembly line	444 ft 3 in.
Merry-go-round	144 ft
Chassis line	642 ft 6 in.
Final line	408 ft
Final OK line	313 ft 6 in.

In addition, there is a common body receiving line—655 ft long—and the body storage conveyors mentioned earlier.

It may be noted that the unit type body on the "600" has effected many modifications in final assembly procedures. For example, the front suspension system is made up as a complete unit ready for attachment to the body structure. And there is no chassis assembly line as known conventionally. The rear shock absorber and rear fender are mounted directly to the body before it reaches the assembly line. Owing to the manner of installation at the front end, the front shock absorbers are not fitted to the suspension assembly but are installed after the suspension has been attached.

The entire front sheet metal assembly, consisting of the fenders, radiator grille, bumpers, etc., is made up—for each line—on a merry-go-round subassembly line at one side of the final lines. This assembly is installed after the front suspension and engine and radiator core are in place. Other detail operations are performed in conventional fashion as the cars move along the assembly conveyor.

The assembly building is well painted and has an excellent system of fluorescent lighting to improve seeing. All of the assembly lines are fitted with overhead mounted Bull-Dog Trol-E-Duct which supplies power to the many portable high cycle tools.

Mention was made earlier of the 50,000 sq. ft. addition to the engine building to provide modern facilities for engine testing and storage. Engines come in from the adjacent manufacturing department, on an overhead monorail conveyor, completely assembled save for accessories. They are taken off the feeder line and mounted on individual floor stands which are moved along a unique type of floor conveyor. This conveyor system, threading the entire area, is flush with the floor so as to leave the work space entirely clear of obstructions. The slats in the conveyor have holes to receive the engine stand at two points.

The conveyor first moves the engines on a loop through the assembly stations at which the various accessories are installed. Then, as the engines reach the test stations, the stands and engines are rolled off the conveyor and moved into place for testing, thus eliminating all overhead bridge cranes and transfers. In effect, each engine stand is a test stand since the engines are not physically removed from the stand until they have completed the run-in and go to the storage bay. The test stands accommodate 70 engines at a time for a test schedule running about 30 minutes.

The foregoing is a sketchy treatment designed to bring up-to-date our impression of this interesting plant. We intend to supplement this article with information concerning the changes now under way after the new equipment has been installed. The pictorial views taken in various departments of the plant should enable the reader to visualize the scope of some of the activity.

Company Formed to Build Tucker Torpedo Car

Ray Rausch, former vice president in charge of production for Ford Motor Co., and several other men prominent in the automobile industry have associated with Preston Tucker, inventor of the Tucker Torpedo car in formation of a new company which will build the automobile. Officers of the new enterprise, named the Tucker Corporation, are: President, Preston Tucker; vice president in charge of production, Ray Rausch; vice president in charge of sales, Joseph D. Burke, formerly a sales executive with Chrysler, Dodge, Packard, and Hudson; vice president in charge of Purchasing, Eugene L. Reason, ex-purchasing agent for Chrysler; general sales manager, H. F. Costello, formerly with Easy Washing Machine Co.; Director of Styling, George S. Lawson, former G.M. designer; superintendent, Joseph H. Bush, former superintendent of Ford assembly plants in St. Louis and Kansas City; and secretary, Maj. Mark J. Mourne, of a Chicago law firm.

Officials of the company said recently in a press conference in Detroit that production could get underway within six months after the firm takes over the Dodge Chicago plant. The Tucker is described as a rear engine drive car, powered by a six-cylinder 150-hp engine. A company spokesman says the car probably will sell in the $1000-$1300 price range.

More 1946 Lincoln Prices Set by OPA

Ceiling prices for three additional Lincoln 1946 model passenger automobiles have been announced by OPA. The following official prices, F.O.B. factory, do not include excise taxes, transportation, or preparation and handling charges.

Lincoln	1946 retail prices	1942 retail prices
Convertible coupe	$2229	$2139
Continental coupe	3394	2989
Continental cabriolet ...	3459	2989

Increased Facilities for United States Rubber Co.

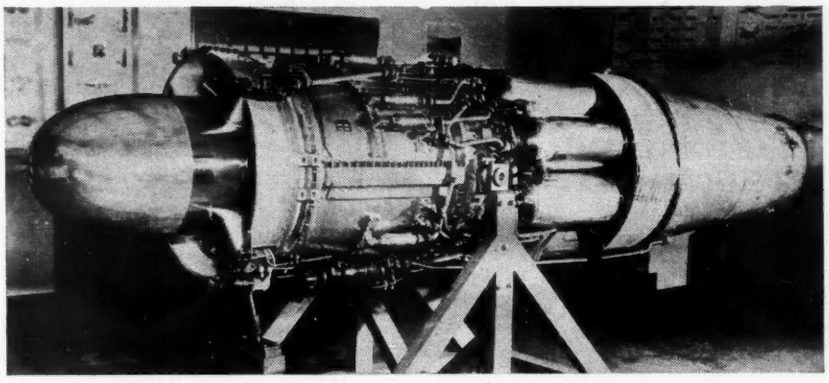
More than $2 million will be spent to expand the facilities of the Naugatuck Chemical Division, United States Rubber Co., at Naugatuck, Conn.

The expansion program includes the construction of eight new buildings, all of which are expected to be in operation before the end of 1946.

Ground will be broken in April for a laboratory and a pilot plant which, when completed, will increase laboratory and pilot plant facilities at the chemical division by more than 50 per cent.

Also scheduled to start construction in April are a plant for the production of rubber chemicals, another plant for the manufacture of small volume products, and a new building to house service departments, such as purchasing, traffic, industrial relations and safety.

GE Jet J-35



Shaped like a streamlined torpedo, this new axial flow turbo jet engine has been developed by the General Electric Co. Known in th Army Air Forces as the J-35, and industrially as the TG-180, the new axial flow jet is said to be more powerful at high speeds than any conventional engine in the air today. The new engine is long and light in comparison with reciprocating engines. The frontal area of the axial flow jet is far less than for any reciprocating engine now in use on large planes. Its advanced characteristics already have resulted in both civilian and military planes being studied and designed to use the new engine at speeds well in excess of 500 mph, around which point the efficiency of propellers begins to decline sharply.

Steel Production Rate

The operating rate of steel companies having 94 per cent of the steel capacity of the industry was 15.2 per cent of capacity for the week beginning Feb. 18, compared with 5.5 per cent during the preceding week, 5.1 per cent one month before and 96.4 per cent one year ago. This represents an increase of 9.7 points or 176.6 per cent from the preceding week.

The week's operating rate is equivalent to 268,000 tons of steel ingots and castings.

Penalties for Engaging In Unauthorized Strikes

The first definite penalty provision against unauthorized work stoppages to be included in a union contract in the automobile industry has been written into the agreement just signed by the Ford Motor Co. of Canada and the UAW-CIO. The penalty clause provides that any worker engaging in an illegal strike shall be fined $3 a day and loss of a year's seniority for each week of participation in such a stoppage. Signing of the contract marked the official end of the union-management dispute, which saw the plant closed down for 99 days by a strike. The agreement was reached through efforts of Hon. I. C. Rand, Canadian Supreme Court judge, who arbitrated the dispute.

Carnegie Illinois Increases Steel Output Capacity

Carnegie Illinois Steel Corp., U. S. Steel subsidiary, has contracted for two new slab heating furnaces and the rebuilding of three existing slab heating furnaces for its Gary, Ind., works, an expansion which will give its strip mill there one of the largest capacities in the world.

The contract was awarded to Rust Furnace Co., Pittsburgh, Pa., which will make the new installations, including machinery and foundations, without interrupting mill operations.

Conciliation Office for Rubber Industry Announced

The first office of the Conciliation Service of the U. S. Department of Labor to be devoted to the labor-relations problems of one industry will be opened March 1 in the Buckeye Building, Akron, Ohio, to service the rubber industry. Paul W. Fuller, the Commissioner of Conciliation who has been assigned to the rubber industry for the last four years, will be in charge of the office. Commissioners Claude Wisdom and George Morrison will assist him.

New Firm to Make Welding Materials

Joseph A. Weiger, vice-president of P. R. Mallory & Co., Inc., and Henry D. Weed, Jr., manager of the Resistance Welding Alloy Division of the company, have resigned to form a new manufacturing firm, the Weiger Weed & Company, to specialize in resistance welding electrodes, electrical contacts and special metallurgical products. Headquarters of the new company will be in Detroit where office and production facilities have been established.

New Products

New All-Position Mild Steel Electrode

A new all-position mild steel electrode, called Airco No. 312, has been brought out by Air Reduction Sales Co., New York City. It was designed primarily to prevent underbead cracking in the welding of hardenable steels.

Laboratory tests and field applications are said to indicate this electrode is satisfactory for welding: Low alloy, high tensile steels, particularly in heavy sections where preheat must be used with conventional type electrodes to minimize cracking; free machining steels which normally run quite high in sulphur; cold-rolled steels where excessive porosity is normally encountered with conventional type mild steel electrodes.

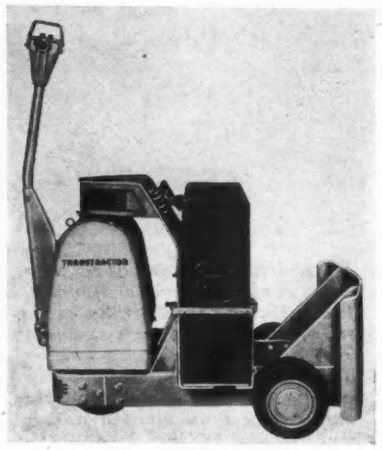
For material to be vitreous-enameled after welding, this electrode makes possible production of highly satisfactory enameled surfaces without any preheat treatment prior to the enameling operation.

New Electric-Propelled Hand Tractor

The Transtractor, a new electric-propelled hand tractor combining features of the electric hand truck and the conventional warehouse tractor, has been announced by Automatic Transportation Co., Chicago, Ill. It will push or pull a 6,000-lb trailer load all day or up to 20,000 lb intermittently, depending upon plant conditions. Fingertip control enables one man to handle any size or type of load.

The new unit was designed specifically for applications requiring a towing type unit but demanding smaller and more maneuverable equipment than standard electric tractors, for example, in picking up separate orders from warehouses and hauling them to scattered points throughout the plant or assembly line. Towing a number of trailers in tandem, the Transtractor allows each order to be loaded separately and reduces the handling required when a hand truck is used to pick up a number of separate orders.

An addition to Automatic's line of Transporters electric-propelled hand trucks — the Transtractor utilizes the chassis, motor and controls of its brothers. It is equipped with front-wheel drive. Forward and reverse drive controls are push-button type operated from the guide handle. Two forward and two reverse speeds are controlled by the vertical angle of the guide handle. Drive brakes are applied by the return of the guide handle which springs upward automatically, when released, to upright position.



The Transtractor

Standard equipment includes a battery capable of eight to ten hours' operation. A portable cabinet plug-in charging unit is available.

Thompson RotoCap Provides Controlled Valve Rotation

The principle of engine valve rotation to prevent valve sticking has been discussed a great deal in recent years, the latest development—stemming from considerable research by Thompson Products, Cleveland, Ohio—being offered to engine builders and fleet operators in the form of the Thompson RotoCap described here.

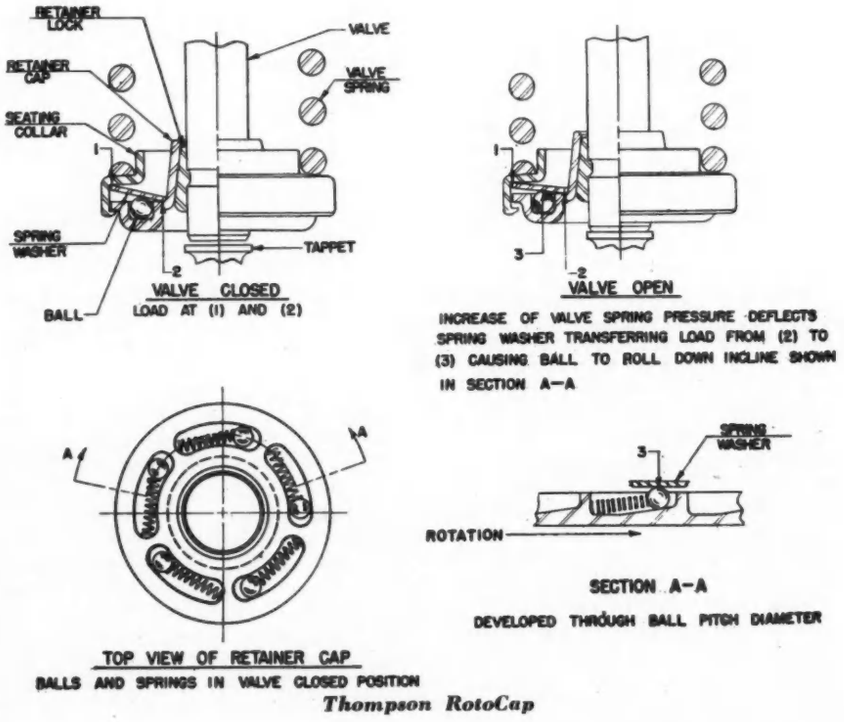
The RotoCap is produced in the form of a self-contained assembly that gives positive controlled rotation, and is installed with the standard locks and retainer neck, the only change being in the spring retainer cap. The RotoCap, therefore, can be installed on any engine either by the manufacturer or by the vehicle operator simply by changing the spring retainer cap.

Slowly rotating valves are said to have many advantages. Valve sticking is eliminated to a great degree since deposits are continually cut from the stem by the rotating action. Block and valve seats are kept clean by the light lapping action resulting from the turning. Thus blow-by is less likely to occur, but should it occur due to distortion, the constant turning prevents the small portion of the valve at the point of blow-by from becoming excessively hot. Ninety per cent of exhaust valve failures are said to be due to sticking and blow-by.

Tests are said to prove that valves giving only 100 hours of service under severe conditions will give from 300 to 500 or more hours of service with the RotoCap under the same conditions.

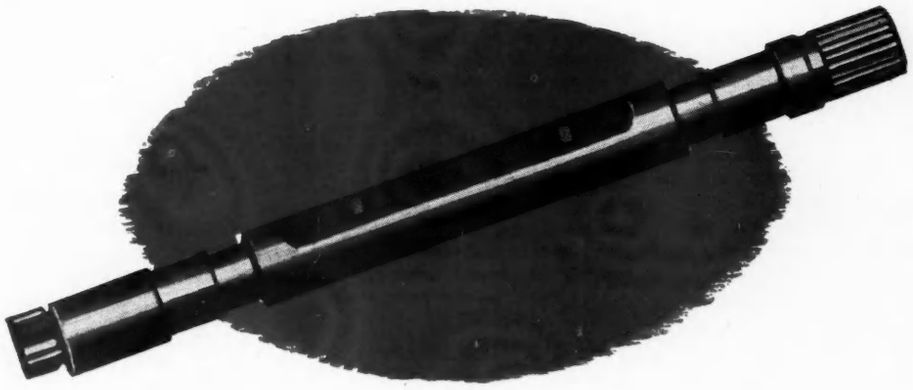
The RotoCap is generally installed between the valve spring and the valve, replacing the conventional spring retainer cap. It consists of five parts as shown in the illustration, the retainer cap, which is locked to the valve stem by conventional retainer locks, containing several circular, helical races. These races contain balls which are continually forced to the shallow ends of the races by small springs. A seating collar furnishes the seat for the valve spring

(*Turn to page* 54, *please*)



Thompson RotoCap

THE 1946 WAY TO CUT PRODUCTION COSTS

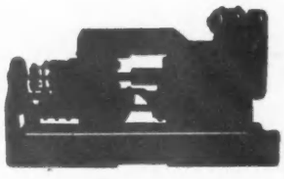


This is an automotive part, 3¼" long, produced from X-1112 bar stock, complete as you see it on a modern Acme-Gridley 6-spindle Automatic—13 operations in 7½ seconds.

To find out just how fast this is, may we suggest that you give your estimators the above picture, without the 7½ seconds, and ask them for a production figure using the equipment now in your shop.

This is a typical example of eliminating rehandling costs—by doing more operations on a modern production automatic—applicable in principle to any precision mass production parts you make from bars or tubing up to 7¾" diameter.

Since production cost is the most important factor in setting the selling price of your finished product, you'll be interested in National Acme parts production guarantees—whatever you make. Our Engineers will be glad to confer with yours—Just write or call us.



ACME-GRIDLEY
BAR and CHUCKING AUTOMATICS
Maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

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and is spun over the retainer cap to form the single compact assembly. Interposed between the seating collar and the retainer cap is a conical spring washer having sufficient resistance so that the load of the valve spring, with the valve closed, produces only a small deflection. This load is carried from the seating collar to the outer edge of the washer at (1) to the inner edge and to the retainer cap at (2).

When the valve is lifted, the valve spring load increases, thus deflecting the washer more and tending to flatten it. The balls, which have been forced up under the washer by the small springs then pick up this load at (3), and as the washer continues to flatten, they roll down their respective races a few thousandths of an inch. Inasmuch as the flattened washer is riding on the balls at this time, rotation of the retainer cap and stem, relative to the washer, and other stationary parts, is thus produced. When the valve is again closed, the valve spring load is reduced and the spring washer assumes its original position.

This gives a controlled amount of rotation for each lift of the valve, and although it is not great, it is said to be sufficient to produce the desired results. Controlled rotation is important, since too little is of doubtful value while too much causes rapid valve wear. It also is desirable to choose a valve steel with good hot hardness, such as Thompson XCR, in order to avoid seat abrasion.

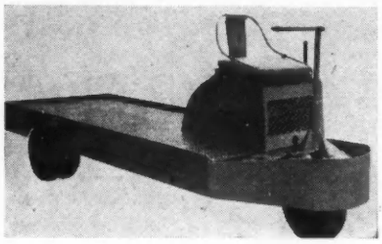
Non-Deforming Die Steel

The Carpenter Steel Co., Reading, Pa., has added a new tool steel to its line of specialized tool, alloy, and stainless steels. The steel is an air-hardening, non-deforming die steel which combines the deep-hardening characteristics of air-hardening steel with the low temperature heat treatment possible with oil-hardening steels.

Named Vega by its inventors, this new steel is said to provide good hardness in heavy sections. harden at low temperatures, keep dimensional changes in heat treatment to a minimum and provide an unusually satisfactory combination of hardness and toughness. It hardens entirely through in large sections by simply cooling from 1550 F in a free circulation of air. In an 8-in. diameter, Vega has a hardness value from surface to center of C-60 Rockwell and at the same time maintains a fine-grained, tough fracture. In smaller sections its hardness values are slightly higher.

Vega, because it can be heat treated from a temperature 200 F lower than 5 per cent chromium air-hardening steels, does not require special high temperature furnaces. This lower hardening temperature also reduces the tendency to scale and holds dimensional changes to an absolute minimum. When properly heat treated Vega may be expected to expand only 0.0005 in. per in. of length, and upon drawing at 400 F will return to within 0.00025 in. of its original size.

Buda Shop Truck



The Buda Chore Boy, Model FF, made by the Buda Co., Harvey, Ill., is a dual-wheel, heavy-duty platform type shop truck of one-ton capacity. It is provided with dual wheels, and has a non-skid deck with a loading space of over 20 sq. ft. The seat cushion is hinged so that when operator leaves the seat, brakes are automatically applied. The new truck weighs 1100 lb, and is equipped with an air-cooled 7.7-hp engine. A transmission of the friction type is employed, with roller chain drive to the rear axle.

Floor Cleaning Compound

Optimus floor cleaner No. 1F10 has been formulated by Optimus Detergents heavy-duty floor cleaning compound, Co., Matawan, N. J. This product is a especially compounded for use on cement, Terrazoo or tile floors.

The manufacturer states that although very effective in removing oil, grease and other dirts from the surface, this material does not harm the finish in any way. In fact, regular washings with Optimus floor cleaner are said to help keep floors in good condition, make them less porous, keep them from dusting, and keep them whiter and cleaner.

Optimus floor cleaner is a base from which a liquid floor cleaner can be made, or it can be applied to the surface directly, and then rinsed off. Used in lower concentrations, it is very effective in industrial floor scrubbing machines.

Electrodes for Specific Hard-Facing Applications

One new and one improved shielded arc electrodes, each of the type designed for specific hard-facing applications, are offered to the trade by The Lincoln Electric Company, Cleveland, Ohio.

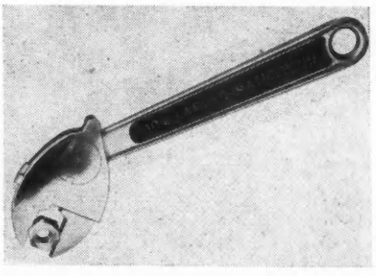
"Abrasoweld AC," designated as a hard-facing shielded arc electrode, is designed for building up straight carbon steel, low alloy steel or high manganese steel with a self-hardening deposit to resist severe abrasion, battering and impact. Although specially designed for operation on alternating current, it may be used for both the industrial type and small, mass-market type welding machines and direct current. This new "Abrasoweld AC" electrode is available in ⅛-in., 5/32-in. and 3/16-in. sizes and is furnished in 14-in. lengths.

"Manganweld A," suspended for the duration, has been improved and is now manufactured specially for reclaiming worn austenitic manganese steel parts containing 11 per cent to 14 per cent manganese. It is said to be particularly well suited for use with direct current machines, and many be used with both the industrial type alternating current and small, mass market type welding machine. This improved electrode is furnished in 5/32-in., 3/16-in. and ¼-in. sizes and 14-in. lengths.

New Automatic, Adjustable, Ratchet-Action Wrench

The "Larc-o-matic," an automatic, adjustable, ratchet-action wrench, is now in production at the Oscar W. Hedstrom Corp., Chicago, Ill. The new wrench provides an instant thumb-trigger adjustment and an automatic "eye" adjustment control that keeps the jaws in constant grip on square, hexagonal, metric, and odd-sized nuts while the wrench handle is in manual operation. In addition, the wrench automatically ratchets and secures a ¼, 1/6, ⅛, and 1/12 turn grip for close-quarter work.

Currently the wrench is produced in three sizes. These are: the six-in. tool,



Larc-o-matic wrench

opening to 13/16 in., the eight-in. model, opening to one in., and the ten-in. wrench, opening to 1⅜ in. Two styles are available, one utilizing a V-groove in the jaws to grip corners and faces of nuts alternately for close-quarter work, and another which has pipe wrench teeth for use on rounded nuts.

Swivel Bolster Simplifies Handling of Long Loads

The Mercury swivel bolster, built by the Mercury Manufacturing Co., Chicago, Ill., is an attachment for handling unusually long loads of steel rods or beams, timber, or other materials. With it, loads too long for one trailer may easily be transported from one location to another.

The swivel bolster consists of two identical assemblies, each of which may

(*Turn to page* 56, *please*)

THIS VERSATILITY

Also Has Many POSTWAR USES

The myriad requirements of war demonstrated the amazing versatility of Vickers Hydraulic Controls. There were so many kinds of jobs to do—jobs which had to be done better than ever before—jobs which had never previously been accomplished.

For example, in this illustration, the plane has Vickers Hydraulic Control for brakes, automatic pilot and cargo door operation. The lift trucks have Vickers Hydraulic Control which lifts and positions the load accurately at the finger-touch of the operator. The graders building air fields use Vickers Hydraulic Power for steering front and rear wheels, raising, lowering or side shifting the blade, and operating the attachments.

These are just a few of the war jobs Vickers Hydraulics have done. Others include the precision movement of heavy battleship turrets—the automatic aiming of anti-aircraft guns—the fast precision positioning of ammunition hoists—the control of bomber gun turrets—and others which, cannot yet be described.

VICKERS HYDROMOTIVE EQUIPMENT

Many of the intricate machine tools that produced the machines that won the war depended for their accuracy, production speed, and ease of operation upon Vickers Hydraulic Controls.

This demonstration of the remarkable versatility of Vickers Hydraulic Controls suggests many new applications to a wide variety of postwar equipment.

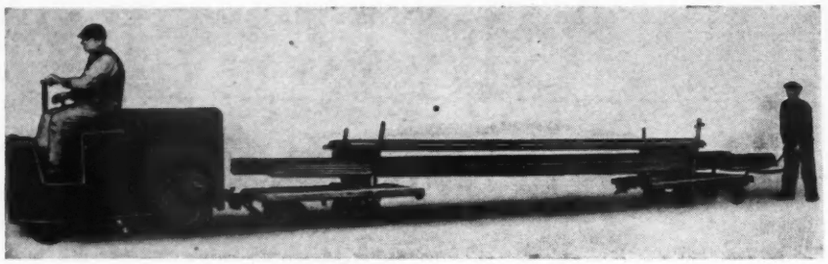
VICKERS *Incorporated* • 1428 OAKMAN BLVD • DETROIT 32, MICH.

Application Engineering Offices:

Chicago • Cincinnati • Cleveland • Detroit • Los Angeles • Newark • Philadelphia • Rochester • Rockford • Tulsa • Worcester

There are more than 5000 Standardized Vickers Units that can be used in various combinations to exactly supply Every Hydraulic Power and Control Function

ANY FEED RATE · ANY TRAVERSE RATE · ANY R P M
ANY SEQUENCE OF MOTIONS · ANY ACCELERATION OR DECELERATION · ANY THRUST . . . . . .



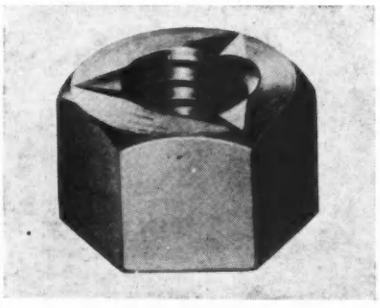
Mercury swivel bolster

be attached to a single caster steer trailer by inserting posts into side rack sockets, making it a simple matter to adjust regular handling equipment to carry loads of extraordinary length.

Supported by bolster assemblies, these ordinarily unwieldy cargoes may then be moved through narrow doorways and aisles and around corners, the lead trailer pulled by a tractor or other suitable power vehicle, and the rear trailer guided manually.

One-Piece Lock Nut

The Grip Nut Co., Chicago, Ill., has developed a new lock nut for general industrial use. The Gripco lock nut is a semi-finished, one-piece, self-locking nut of standard dimensions, not affected by oil, water or chemicals. The Gripco



Gripco lock nut

lock nut requires no lock washers or cotter pins, and a wrench is all that is needed to apply or remove it. The triangular deflections on the top of the nut provide a controlled friction lock. The nut is free-spinning until the bolt threads contact the deflected threads near the top of the nut.

Aluminum Bronze and Phosphor Bronze Electrodes

The Metal and Thermit Corporation, New York, N. Y., presents a new Murex line of heavy-coated aluminum bronze and phosphor bronze electrodes. The new Murex electrodes make available a wide range of bronze alloy deposits varying in chemical analyses and in mechanical properties from high tensile strength and ductility with comparatively low hardness, to medium strength with zero ductility and relatively high hardness. The deposits are said to have good wearing and bearing characteristics and excellent corrosion resistance.

Top-Fired Crucible Melting Furnace

A top-fired crucible melting furnace, using two crucibles in tandem, is offered by Radiant Combustion, Inc., of Warren, Ohio. This new furnace holds

Crucible melting furnace made by Radiant Combustion, Inc.

two crucibles, loaded at all times and alternately fired.

While the gas or oil flames are heating the first crucible, all of the flue gases produced are carried by a connecting flue to the second chamber to preheat the second crucible. During the pouring of the metal from the first or fired crucible, a third crucible replaces the removed crucible to receive cold metal.

The covers are cam lifted and swung backward independent of one another allowing each side to be alternately fired.

Among the advantages claimed from this new furnace, by the manufacturer, are faster heating through combined radiant and convection heating, burners cannot plug because they are in the top where slag or metal cannot reach them, and lower metal loss as the flame does not impinge on the metal. The metal is visible at all times and temperatures can be taken whenever desired without shutting off the burners. The lining is easy to replace as there are no burner ports to contend with. Flue gases can be flued through the floor.

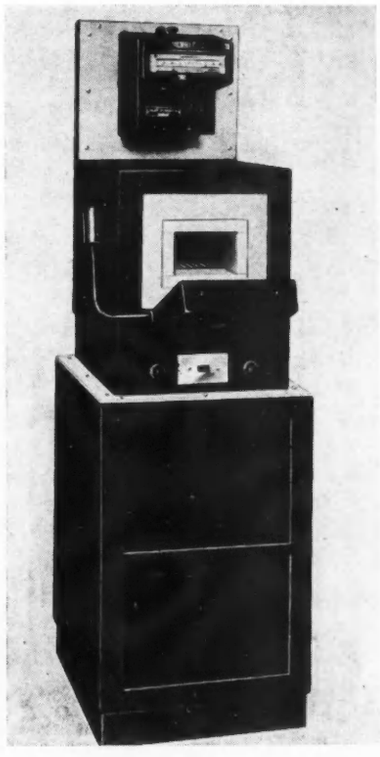
Experimental Molding of Small Phenolic Pieces

Grayhill, Chicago, Ill., is now equipped to mold small phenolic pieces on a low production basis of two to three thousand of a unit per year. Enough to supply parts for pre-production runs and salesmen's samples while a large production mold is under construction. Grayhill has made the cost of a mold no longer a serious factor when customers desire to have small parts molded to be used experimentally in their own products. They specialize in single and two cavity molds at a low cost as compared to the cost of regular production molds.

Parts which demand very close tolerances are molded; then, because of uneven expansion and contraction as a result of cooling, these parts are machined.

Furnace for Treating High Speed Steel

A new high temperature furnace, to be known as the Huppert "Hi-Temp" furnace, has been especially designed by the K. H. Huppert Co. of Chicago to meet the need for a small capacity unit for precision treating of high speed steel reamers, cutters, tools, etc. This furnace is recommended by the manufacturer for continuous operating temperatures up to 2200 F., intermittent to 2250 F. It is available in floor and table models. Both models are furnished complete with automatic temperature control and feature multi-insulation, high temperature alloy elements, "on-off" switch, two pilot lights (one for indicating that furnace is operating



Huppert Hi-Temp furnace

and the other serving as a safety light to indicate any failure occuring in heating elements), all-steel construction, counterbalanced door, and black wrinkle finish. Both models operate on 110 volt, alternating current only.

(*Turn to page 58, please*)

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

The National Advisory Committee for Aeronautics proposes to release to schools, libraries and industries over 300 technical reports hitherto secret.

get ready with CONE for tomorrow

Lycoming is experimenting with two new aircraft engines: a 36-cylinder, 5,500 lb. radial developing 5,000 h.p., and a 12-cylinder, 2,100 h.p., weighing only 1,445 lbs.

get ready with CONE for tomorrow

Monsanto Chemical Co. has a plastic armor plate that has shattered machine gun bullets in tests.

get ready with CONE for tomorrow

Curtiss-Wright is working on an "uninhabited" airplane capable of 1,400 miles per hour.

get ready with CONE for tomorrow

Firestone is making a heavy-duty tire with a wire carcass for off-the-road trucking.

get ready with CONE for tomorrow

A new distillery, the largest of its kind in the Western Hemisphere, will be built in Maine to make alcohol from Aroostook County potatoes.

get ready with CONE for tomorrow

Shell Oil Company has a new combustion head for gun-type domestic burners that will cut fuel consumption 20% and is suitable for use on burners now in operation.

get ready with CONE for tomorrow

Eastman Kodak promises that any reasonably well equipped amateur will soon be able to make his own color transparencies and prints.

get ready with CONE for tomorrow

Jack and Heintz will manufacture the Skinner gasoline engine. This is a double-opposed "pancake" type, made largely of aluminum with a compression ratio of 8 to 1 and a weight of less than 2 lbs. per h.p.

Mellon Institute has found, after thorough testing, that solid magnesium alloys do not burn.

get ready with CONE for tomorrow

The Weather Bureau has begun a survey of the country's wind resources in anticipation of the use of wind power for generating electricity.

get ready with CONE for tomorrow

A new kind of glass made by American Optical Company transmits 90% of visible light rays, but only 10% of heat rays.

get ready with CONE for tomorrow

Fifteen years of research have led to a form of porcelain enamel, made by C. Hommel Co. of Pittsburgh, that is so thin as to be practically chipless.

National Carbon Company has a new oil made with a secret non-petroleum base, called "Prestone Motor Oil" that shows very little change in viscosity from 30° below zero to operating temperature.

get ready with CONE for tomorrow

Illinois Central and Edison General Appliance Co. have collaborated on the first all-electric dining car, scheduled to go into service early in 1946. The car has its own diesel generating plant which supplies all facilities for cooking, freezing, dish washing, garbage disposal and air conditioning.

get ready with CONE for tomorrow

The Celotex Corporation has patented a process for making building planks out of excelsior and Portland cement.

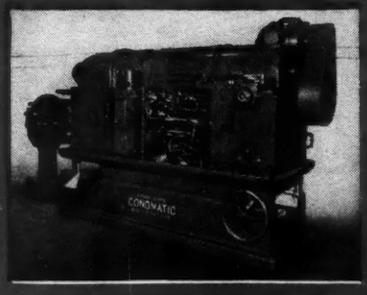
get ready with CONE for tomorrow

Another substitute for natural paint brush bristle is made of casein and was developed by the Eastern Regional Laboratory of the U. S. Department of Agriculture.

3 of these diameters are eccentric

This washing machine part, made of B-1112, is machined from round stock on a 1⅝" 8-Spindle Conomatic in 10 seconds. Three of its five diameters are eccentric to .018".

Write to Cone for particulars.



Ask your CONE representative to show you our new color motion picture

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

26

The Shadowcount

Device for High-Speed Counting of Objects

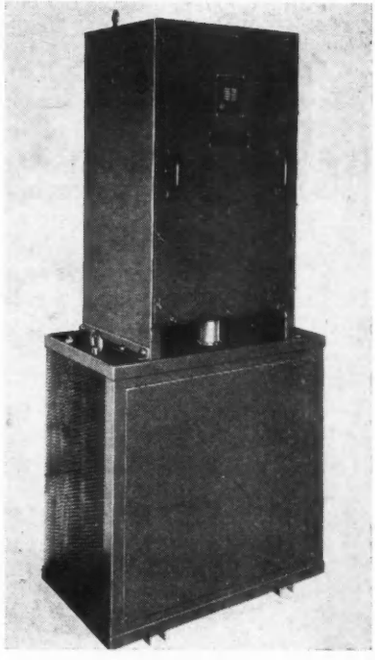
The Shadowcount, made by the Autotron Co., Danville, Ill., is a device for high-speed counting of objects, particularly those of small size or light weight.

This method of counting was made possible by development of very high speed, sensitive electronic circuit which responds not only to the impulses of rapidly moving objects but also to those moving in very rapid succession.

The Shadowcount combines the use of a photoelectronic circuit with an optical system in which a short light beam is sharply focused through an aperture in a steel tube or guide. The focal point of the beam falls in the exact center of the tube so that objects being counted break the beam as they are fed through from the open end of the tube, thus eliminating the use of mechanical contacts. The tube is placed in a vertical position so that pieces being counted fall through by the force of gravity.

Power Factor Regulator

The Haug System power factor regulator, has just been introduced by the Modern Control Equipment Co., Chicago, Ill. The maker states that when the device is connected to the lines of commercial power users, it will raise



Hang System power factor regulator

the power factor by taking the magnetizing current off the line with negligible cost in operation. It is said to increase low voltage to desired value where voltage was previously low due to poor power factor. The power factor regulator will take a current from the line that is practically all reactive and therefore represents very little energy charge. The capacitors consume an average of 3⅓ watts per kva.

Mating Serrations Permit Precision Setting of Nut

A 60-station adjustment nut, manufactured by the E. S. Firestone Engineering Co., North Hollywood, Cal., permits precision setting through the utilization of mating serrations which permit the nut to be set at exact tension and locked in position by the conventional cotter-pin.

Pin-Point-Adjustment permits micro-

(*Turn to page* 60, *please*)

So much more...for so little more

AMERICA'S SUPER FINE BALL BEARING

30% More Load · 30% Longer Life
Silent Operation
Extreme Precision
Supreme Performance
Each Bearing Radio Tested
Used in America's Finest Machines

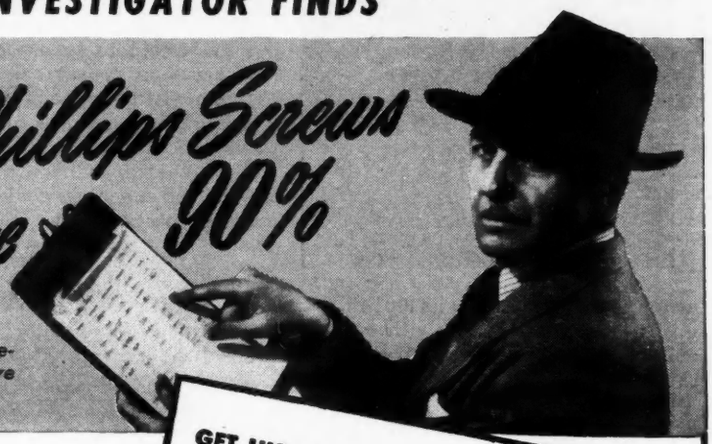
HOOVER

The Aristocrat of Bearings

HOOVER BALL AND BEARING COMPANY, ANN ARBOR, MICHIGAN

INDEPENDENT INVESTIGATOR FINDS

Sonotone uses Phillips Screws to reduce case breakage 90%



This investigator from James O. Peck Co., industrial research authorities, is visiting a number of representative plants to get authentic FACTS on assembly savings.

GET HIS FACT FILLED REPORTS ... GET THE COMPLETE STORY

Every driver skid eliminated saves $1.35 reclaiming costs!

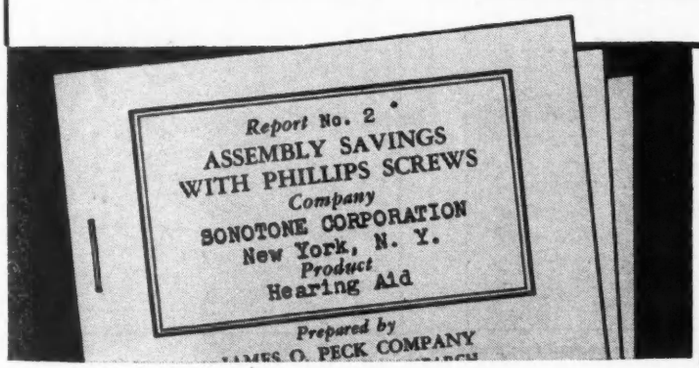
SONOTONE CORPORATION uses Phillips Screws because they lower costs and improve the product . . . the same simple but all-important reason why thousands of other successful manufacturers use them.

TO GET THE FACTS, to determine the actual savings, the investigator studied Sonotone's assembly methods, asked the same questions you would ask. He was told that, with slotted screws, breakage of the fine, hard plastic case of the Sonotone hearing aid would be ten times greater than with Phillips screws. Reclaiming, which involves not only the cost of a new case half, but also the cost of disassembly, reassembly and careful matching up of

case halves, amounted to $1.35 per unit. The burr-free, ornamental Phillips recess is another reason why Sonotone chose Phillips Screws. Read the complete, revealing story in the Sonotone report.

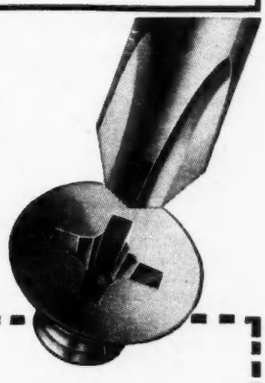
THE ASSEMBLY STUDIES cover all types of products – metal, plastics, wood – show how the many Phillips Screw advantages add up big savings you can make in your assemblies.

THE REPORTS now ready – and more to come – comprise a practical manual of modern assembly methods, never-before-printed information, inside facts you'd pay good money to get, – and it's yours, now, FREE!



PACKED WITH IDEAS FOR SAVINGS IN YOUR ASSEMBLIES!

Whatever you make you'll find how all assemblers licked problems like your own. Get these reports. The coupon will bring those ready now, and the rest as they are issued. Fill it in and mail it – TODAY!



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div.
Elco Tool & Screw Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.

27 SOURCES

Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg.Co.
New England Screw Co.
Parker-Kalon Corp.
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Wolverine Bolt Co.

PHILLIPS SCREW MFRS.,
c/o Horton-Noyes
2300 Industrial Trust Bldg., Providence, R. I.

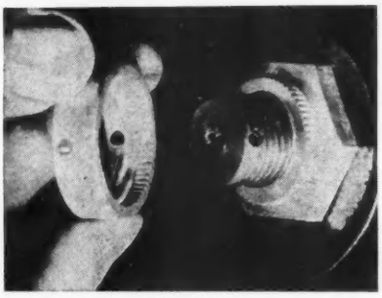
Please send me the reports on Assembly Savings with Phillips Screws

Name.....

Company.....

Address.....

.....



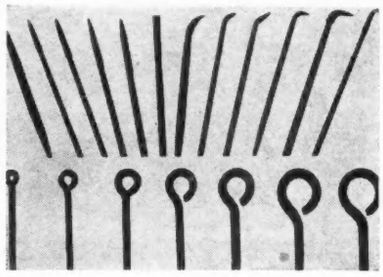
Pin-Point-Adjustment nut

meter settings to as low as .001 in. take-up on 16-pitch threads with considerably finer adjustment possible on threads with increased pitch.

It is said to be especially adaptable to securing proper spindle bearing adjustment to eliminate wheel wobble and achieve perfect wheel alignment and for airplane wing bolts, transmissions, drive shafts, instruments and all high precision machinery where fine adjustments are required.

Hand-Forged Deburring Tools

A line of hand-forged deburring tools has just been placed on the market by Metal Products Co., South Bend, Ind. The line features seven distinct types, each in varying sizes. Channel knife type comes with sharp or square point to remove burrs from long channels and holes in machined castings. For deep holes or cross channels, there are 45- and 90-deg angle hooks, as well as radius-curved ends, in long or extra-long sizes. The Series "F" straight



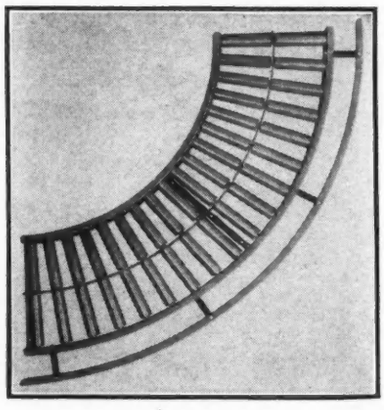
Deburring tools made by Metal Products Co.

scraping tool is useful for general scraping jobs, but is prescribed particularly for removing exterior burrs on machined castings. A "button hook" shaped deburrer comes in seven separate graduations. The complete line is made of tool steel, unimpeded operating shafts from 4¼ in. to 9 in. in length, hollow-ground, hardened, and specially tempered. The tools are ready for immediate delivery, singly, unassembled, or in ready-made complete sets with non-splitting handles.

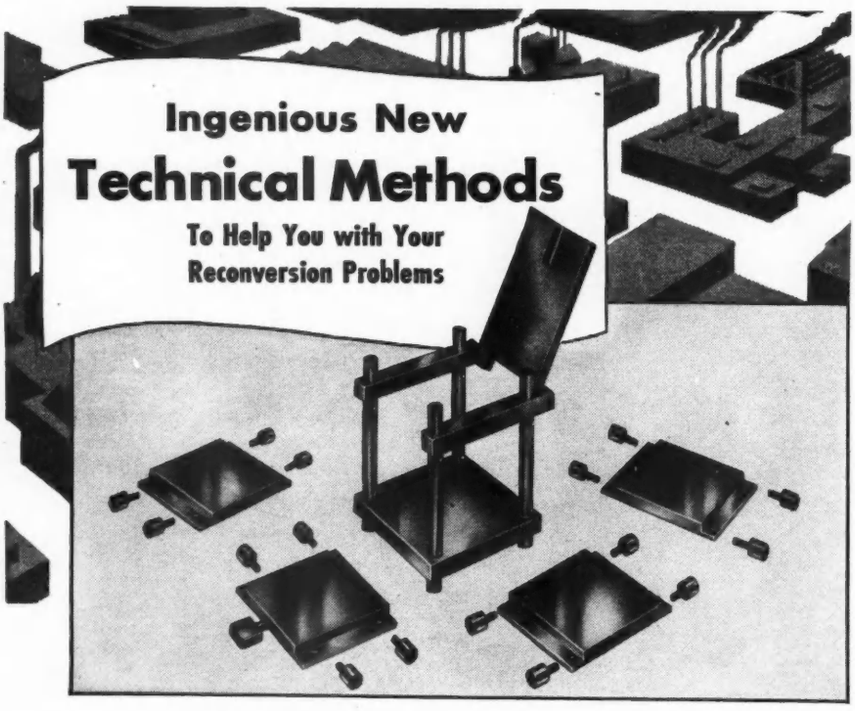
Gravity Roller Conveyors

Lyon Metal Products, Inc., Aurora, Ill., is marketing a completely "packaged" line of gravity roller conveyors. These conveyors have a number of industrial uses for the handling and transportation of cartons, bales, packages, boxes, crates and other types of articles and merchandise. They are presently available in these sizes: Three straight sections, all 10 ft., long and in three widths, 12 in., 18 in. and 24 in.; three 90 deg. curved sections, 12 in., 18

(*Turn to page 64, please*)



Lyon roller conveyor



Drillet Box Jig Saves Up to 75% of Jig Body Expense and Labor!

The six-sided Drillet Box Jig above and at right has a range of 125 different sizes, making it possible to accommodate all sizes up to 6" capacity—for drilling, reaming, counter boring, counter sinking, spot facing, tapping, etc.

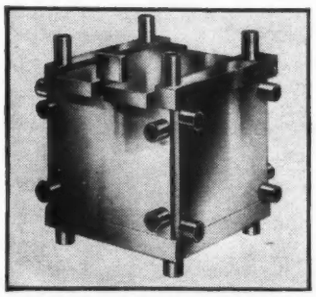
The Drillet Box Jig makes special tool design for drill jig unnecessary. Saves up to 75% of the time and cost of building a jig body. By merely turning thumbscrews and raising leaf, parts may be quickly loaded or unloaded. The jig may be used on all six sides, taking advantage of its full capacity.

Another useful product is chewing gum. You can enjoy chewing Wrigley's Spearmint Gum even while your hands are busy. The pleasant chewing helps to steady you—helps keep you alert and on your toes when you're doing a monotonous job.

Besides the satisfaction chewing gives you, it helps keep your mouth moist and fresh so you naturally feel better—and feeling better you work better.

Scores of industrial plants report that they have stepped up their workers' morale and efficiency by making chewing gum available to them.

You can get complete information from The Chicago Drillet Corporation, 920 S. Michigan Ave., Chicago 5, Ill.



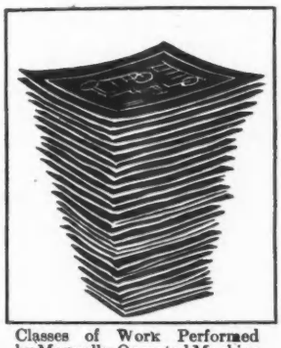
Drillet Box Jig in Locked Position

AA-59

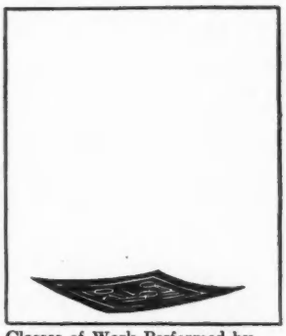
The reason is...

BULLARD MAN-AU-TROL

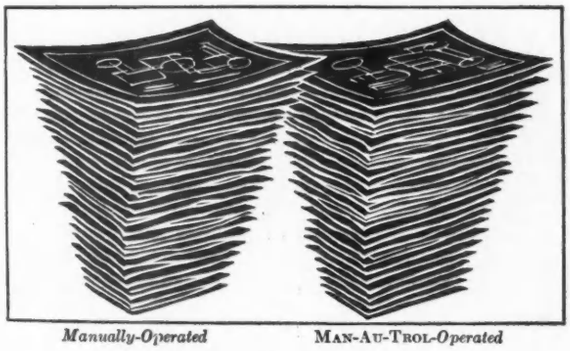
The automatic control that is as versatile as manual control



Classes of Work Performed by Manually-Operated Machine



Classes of Work Performed by Usual Automatic Machine



Manually-Operated MAN-AU-TROL-*Operated*

Classes of Work Performed by Machine Equipped with MAN-AU-TROL

The proof is...

BULLARD MAN-AU-TROL

Vertical Turret Lathe

No longer must an automatic machine be essentially a special-purpose machine

The Bullard MAN-AU-TROL principle of automaticity makes a manually-operated machine *100% automatic* . . . gives it all the production advantages such a revolutionary transformation implies . . . without affecting its multi-purpose nature.

In fact, the nature of that machine acquires a broader versatility. Everything it *can do* as a manually-controlled machine, it can still do under *either* manual or automatic control.

The production-increasing, cost-lowering possibilities of such a unique manually-*or* automatically-controlled machine are worth investigating. Its *quick, easy adaptability* to one-piece, small-lot or long-run jobs will help you take diversified schedules and changing specifications in stride . . . will give you cost and delivery advantages in competitive markets.

At present, MAN-AU-TROL is being built into Bullard machines only.

The Bullard Man-Au-Trol Vertical Turret Lathe gives you the following advantages:

1. *Lightens Labor's Load* because the operator machines the first piece under manual control while easily setting the best production method into an automatic cycle . . . then merely loads, supervises and unloads when MAN-AU-TROL's 100% automaticity takes over.

2. *Makes One Machine Do More* because it automatically machines any class of work within manual-control range . . . is instantly convertible to manual operation on the same or a different piece without affecting the automatic cycle.

3. *Cuts Automatic Set-up Time* because set-up time from one class of work to another is only slightly more than for a manually-operated machine.

4. *Reduces Spoilage* because it operates continuously to a degree of accuracy no manual operator can duplicate.

Many other advantages of the Bullard MAN-AU-TROL Vertical Lathe are covered in Bulletin MAV-G-1. Write for your copy today. The Bullard Company, Bridgeport 2, Connecticut

TO MAKE MACHINES DO MORE

in. and 24 in. wide; two trestles 18 in. and 24 in. wide. Each item is a complete unit.

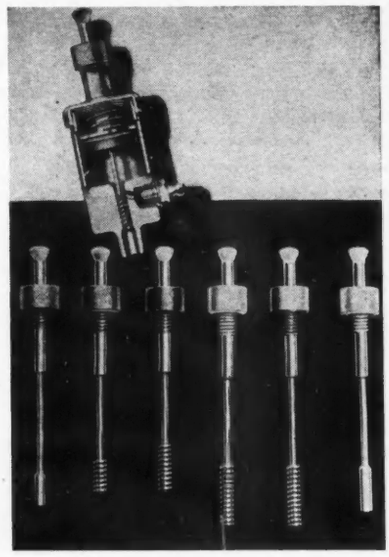
Transportation on Lyon conveyors is by gravity—the rollers are not driven by power. They are also employed in level sections for assembly and packaging operations.

Gun-Fil Lubricators For Industrial Bearings

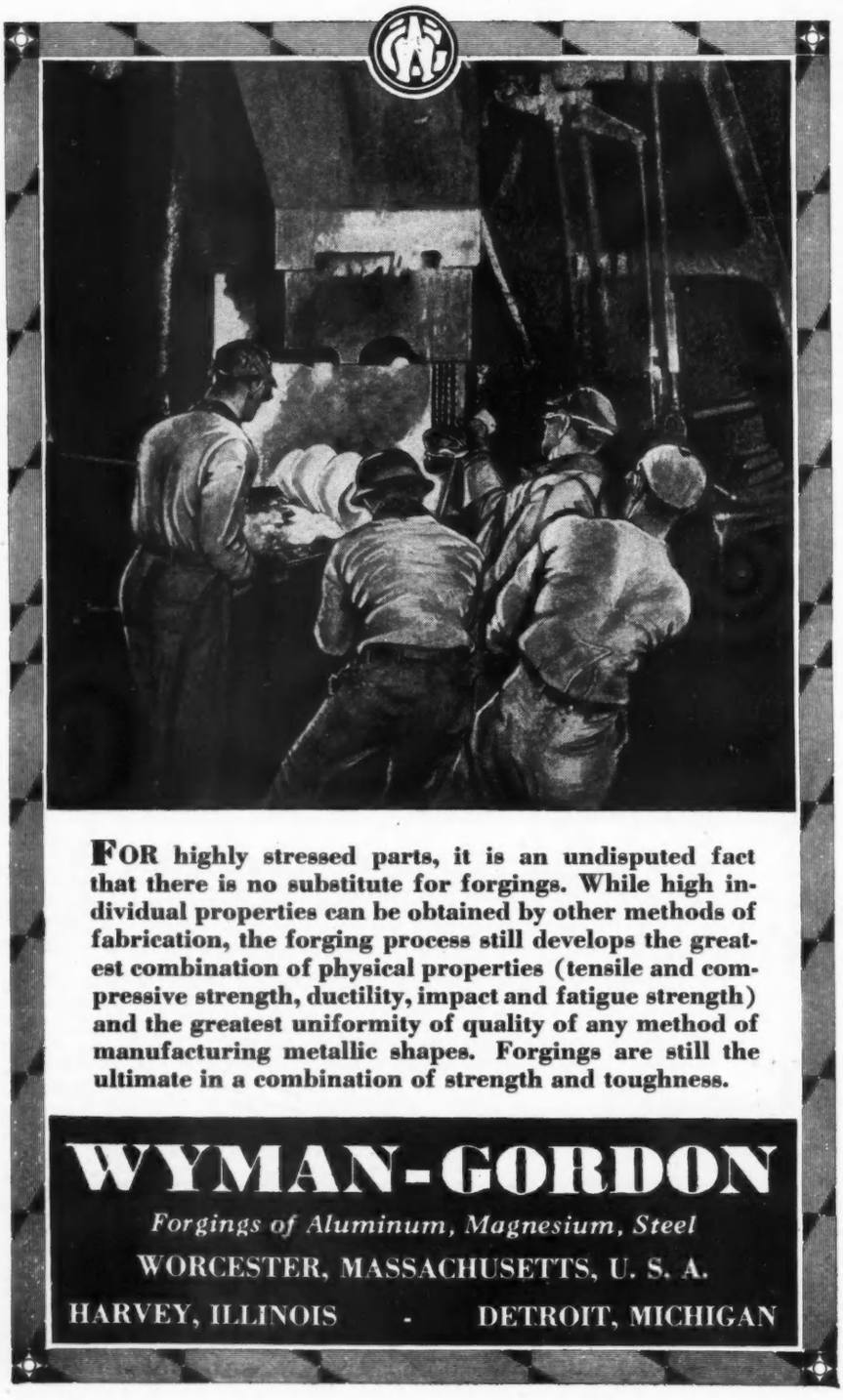
Manufacturing rights on Gun-Fil lubricators have been acquired by the Gray Co., Inc., Minneapolis, Minn. Gun-Fil lubricators are now in production as part of the Gray Company's industrial line of lubricating and maintenance equipment.

Designed in four sizes, with lubricant capacities ranging from ½ oz to 8 oz, pressure filled Gun-Fil lubricators automatically dispense oil or grease in a measured, uniform flow to a moving bearing, and stop feeding lubricant when a bearing becomes motionless.

Six interchangeable valves are available with distinctive colored caps for identification. The valves with colored caps exert varying degrees of control of feed on greases of different densities.



Gun-Fil lubricator and interchangeable values

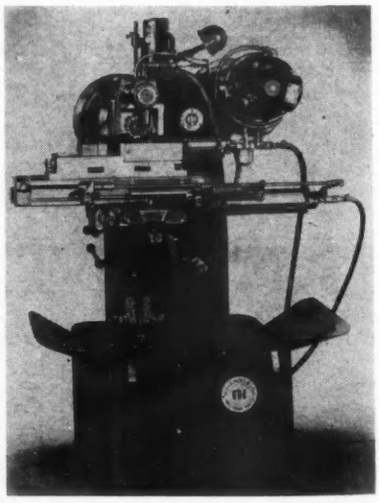

FOR highly stressed parts, it is an undisputed fact that there is no substitute for forgings. While high individual properties can be obtained by other methods of fabrication, the forging process still develops the greatest combination of physical properties (tensile and compressive strength, ductility, impact and fatigue strength) and the greatest uniformity of quality of any method of manufacturing metallic shapes. Forgings are still the ultimate in a combination of strength and toughness.
WYMAN-GORDON
Forgings of Aluminum, Magnesium, Steel
WORCESTER, MASSACHUSETTS, U. S. A.
HARVEY, ILLINOIS - DETROIT, MICHIGAN

Power Table Feed for Nichols Miller

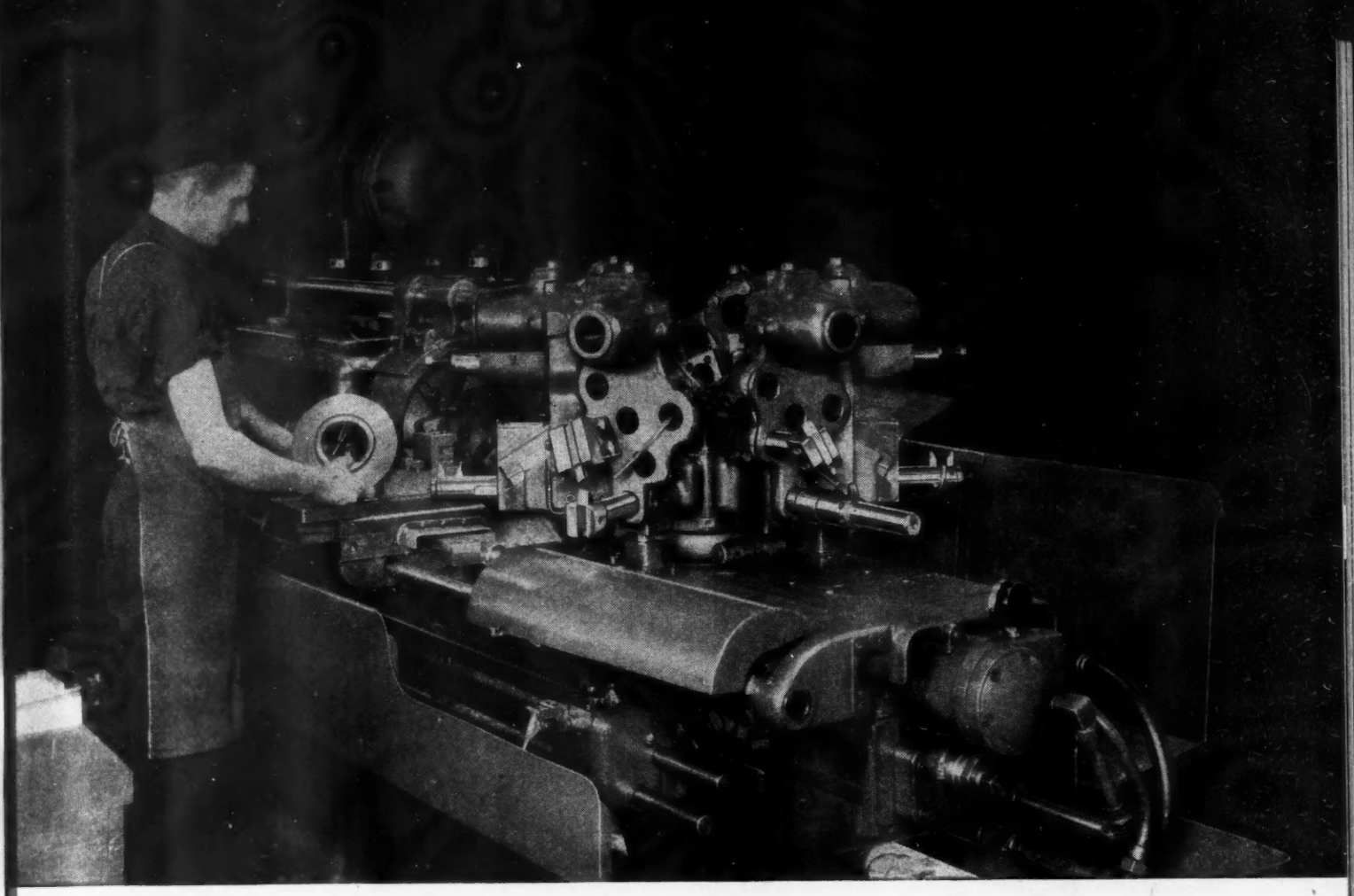
W. H. NICHOLS & SONS, Waltham, Mass., offers a power table feed attachment for the Nichols miller. This attachment can be added at the Nichols factory, or in the field on any Nichols miller now in use. When shipped for field installation, a complete kit is supplied so that no extras are required.

This power feed attachment offers rapid approach, maximum proper cutting feed, fast table return and shut-off. Basically this attachment is a Bellows air feed unit used in conjunction with a Hydro-Check. Both the air and hydraulic units are infinitely variable to suit the work being produced.

The maximum cutting stroke with this attachment is 9 in. It can be operated from any shop air system carrying 75 to 175 psi.



Power table feed mounted on a Nichols miller

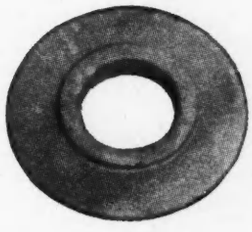


How the *FASTERMATICS* Pay Out Faster, too!

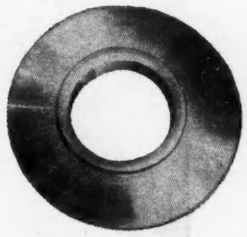
• It may seem incredible, in this day and age, for any major machine tool to "buy" itself in nine weeks' operation. Yet that's exactly what the Fastermatic did on this job of machining clutch plate hubs.

With automatic control of all machine functions, this Fastermatic reduced the former time of 15 minutes per piece, on hand-operated turret lathes, to only 3 minutes, floor to floor. Earnings piled up so fast over former production costs that the Fastermatic paid for itself in only 9 weeks, or 893 hours of operation.

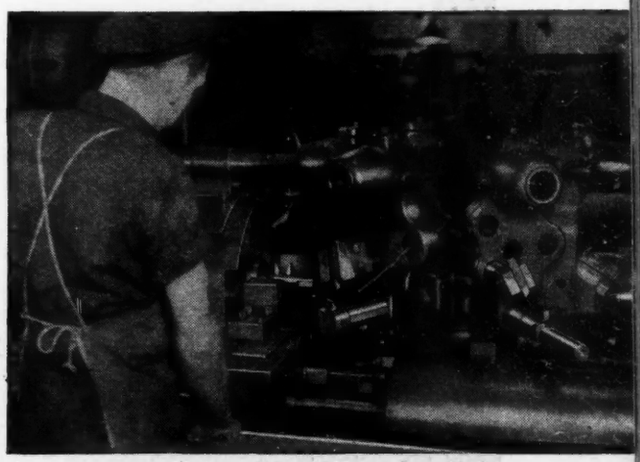
If you have work that will permit a number of cuts to be done in one chucking, investigate what the Fastermatic can accomplish to bring you faster, more efficient production and lower costs. Ask for full information.



Rough Steel Forging



Machined Clutch Plate Hub



In this tooling set-up, only three turret faces are needed to turn each part. By repeating the tooling on the remaining three faces of the hexagon turret, two parts are machined with each complete turret cycle. The operator has only to load and remove the work.

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TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

New Chrysler De Soto Models

(*Continued from page* 25)

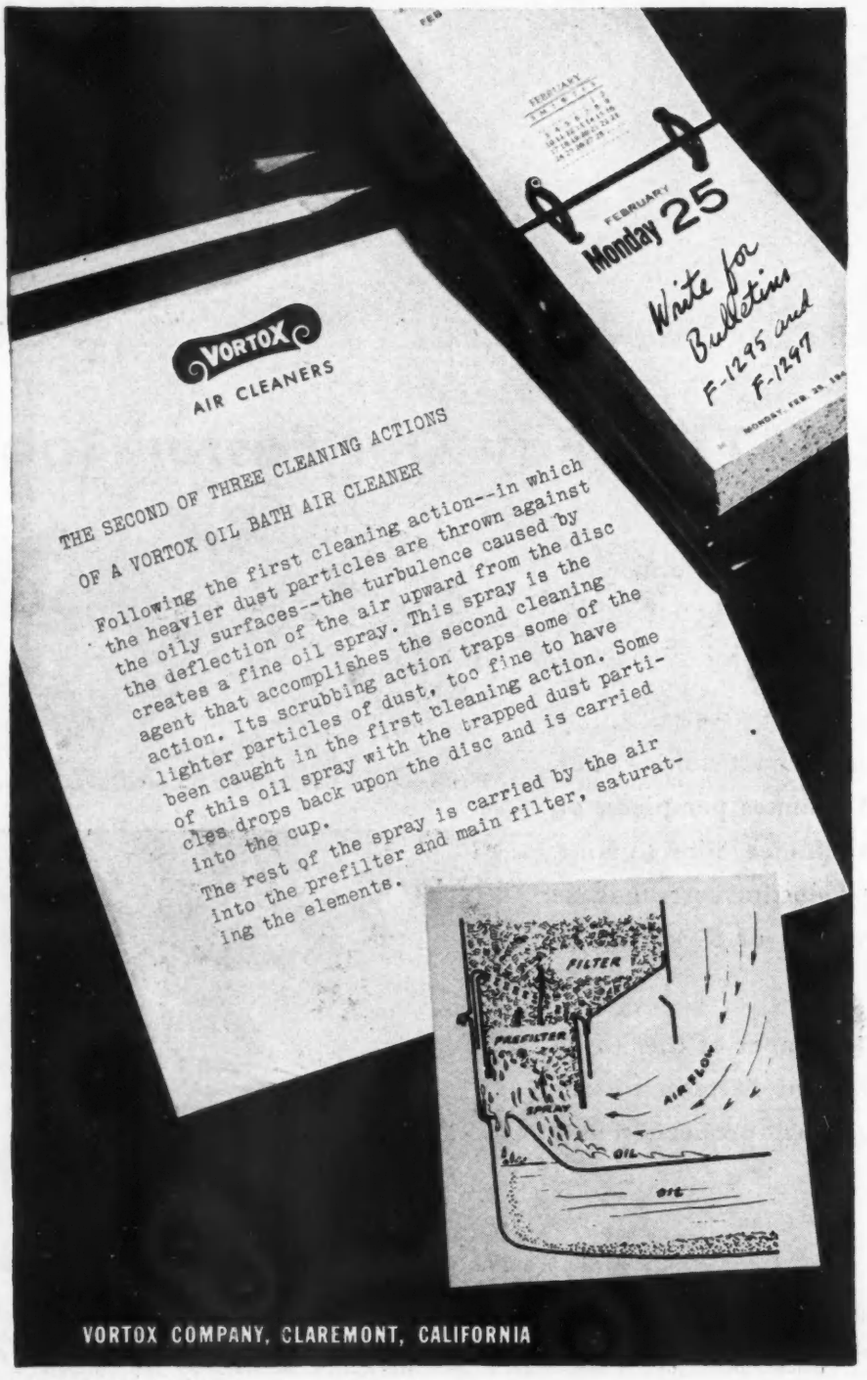
their details are different from the 1942 units. The engines of all three makes have very much the same general changes. They have U-slot aluminum alloy pistons with plated finish and improved copper-asbestos cylinder head gaskets. Improved intake manifolds will be installed in later production. A number of changes have been made in the location of items in the electrical system. Starting now is by push button on the dash. The ignition coil has been moved from the dash to a location directly above the distributor and mounted on a bracket attached to the cylinder head. Ignition wiring has been shortened and held closer to the cylinder head in a bracket which also serves as the coil support. The regulator control case is dust and waterproof and has been moved to a location on the engine side of the left front fender panel. De Soto and Plymouth now have engine starting by push button on the dash.

Greater cooling effectiveness is said to be secured on the Chrysler eight by the adoption of a heavier terne plate water distributor tube of new design. The cylinder barrel is moved ⅛ in. to permit the fitting of the tube between the valves and cylinder walls. This engine also has a new cylinder head with improved reinforcing and a new water pump with larger ball bearings. The Chrysler six and the De Soto engines have heavier terne plate water distributor tubes.

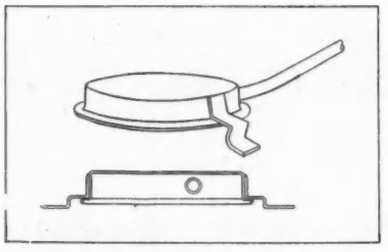
The Chrysler engines have a full-flow oil filter with replaceable elements. The De Soto and Plymouth have an improved sealed oil filter with a paper element of radial type which was developed during the war on military vehicles. High capacity rotor type pumps replace the gear type pumps formerly used on the Plymouth and De Soto.

All Chrysler corporation cars for 1946 will be fitted with the Oilite fuel tank filter which was developed originally for installation in military vehicles. As illustrated, it consists of a shallow sheet metal stamping with the filter disk held in place at the bottom. The assembly is supported by legs soldered to the floor of the tank and stands about one inch from the bottom. Clean fuel is drawn out by the fuel pump through a tube on the side of the filter housing. It is said that the filter element is self-cleaning, owing to the sloshing action of the fuel tank, and prevents the passage of both dirt and water.

This filter provides an interesting use of Oilite—the porous powdered metal material so widely used for bearings, bushings and other applications. In this application, however, the Oilite is not oil-impregnated. Instead it is tin-plated, a procedure said to prevent the formation of gum on the element.


FEBRUARY
Monday 25
Write for Bulletins F-1295 and F-1297
VORTOX
AIR CLEANERS
THE SECOND OF THREE CLEANING ACTIONS
OF A VORTOX OIL BATH AIR CLEANER
Following the first cleaning action--in which the heavier dust particles are thrown against the oily surfaces--the turbulence caused by the deflection of the air upward from the disc creates a fine oil spray. This spray is the agent that accomplishes the second cleaning action. Its scrubbing action traps some of the lighter particles of dust, too fine to have been caught in the first cleaning action. Some of this oil spray with the trapped dust particles drops back upon the disc and is carried into the cup.
The rest of the spray is carried by the air into the prefilter and main filter, saturating the elements.
FILTER
PREFILTER
SPRAY
AIR FLOW
OIL
OIL
VORTOX COMPANY, CLAREMONT, CALIFORNIA

With the Oilite filter the only function of the filter screen at the fuel pump is to trap such dust, dirt, water, or chips as may have collected in the fuel system during manufacture or installation in the car. Once this foreign material has been trapped, it is claimed that the fuel pump filter has no further function and requires no further attention.



Sectional view of Oilite Fuel Tank Filter.

New Brake Shoe Arrangement

A new type of hydraulic brake system, introduced in 1940 on Chrysler eight-cylinder cars, has been improved

(*Turn to page* 68, *please*)

MEMO TO: *Automotive Engineers*

Houdry licensees can meet your high-octane requirements with minimum lead!

Future improvement of engine efficiency by changes in basic design, or by changes in ignition and carburetor adjustments, depends upon the availability of high-octane fuels. But if a gasoline is of low quality to begin with, there is a limit to which its octane may be raised simply by the addition of lead. And the road performance of such a gasoline will be inferior to that of catalytically cracked gasoline which obtains high octane wholly or principally by its inherent composition.

17 Houdry licensees, with 60 Houdry and TCC catalytic units in operation or under construction, are equipped to provide motor gasoline of far higher than "pre-war" quality, using a minimum of T.E.L. The high quality of their output is inherent in the catalytic cracking processes they employ.

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HOUDRY CATALYTIC PROCESSES
IN VICTORY IN WAR AND PEACE

and installed as standard equipment on all 1946 passenger car models built by the Chrysler Corp. and its divisions. The principal mechanical feature of the system is the dual cylinder arrangement on the front wheel brakes with the fixed anchors located 180 deg apart and so positioned that rotation of the drum in forward motion is always directly toward each anchor. The effect is that all four front brake shoes are self-energizing in forward braking and that each of the front shoes delivers equal output. With six shoes self energizing, front and rear, the required pedal pressure is reduced as much as 25 to 30 per cent according to Chrysler engineers. The single cylinder setup is continued in the rear wheel brakes. Brake cylinders have a uniform bore of 1⅛-in., making it possible to use the same aluminum piston interchangeably both front and rear.

Six Chrysler Models

Chrysler's 1946 line comprises six models and 25 body types, with at least two more body types to be added in the Crown Imperial model, which will be announced later. The several models are known as the Royal, with six body types; the Windsor, with seven body types; the Town and Country, with four body types; the Saratoga with four body types; the New Yorker with five body types, and the Crown Imperial. The Royal, Windsor, and Town and Country are powered by six-cylinder engines, the New Yorker, Saratoga, Town and Country convertible and Crown Imperial by eights.

In the front-end treatment, there is a new low, wide grille with horizontal chrome-plated grille bars, and vertical bars added to the grille openings. The body belt molding design is wider and extends forward about a foot beyond the windshield. New and more massive bumpers are used front and rear, extending around the sides of the fenders. New bumper-guards are more massive. The gravel deflector now is mounted on the body instead of the bumper.

Wheels on the 1946 models have been reduced from 16 to 15 in. in diameter. Tire sizes are 6.50 for the Royal, Windsor and Town and Country; 7.00 for the Saratoga and New Yorker.

The interior of all models has been enriched, including a new instrument panel, a perforated metal radio screen finished in chrome and set behind a plastic radio grille, and a plastic three-spoke steering wheel with the horn ring recessed into the spokes. A new handbrake warning signal is located under the left side of the dash and an entrance light in the front compartment under the instrument panel operates automatically with the opening of the door or may be turned on and off manually.

The choice of upholstery is a wide one. In the Royal and Saratoga, pile fabric and cloth are standard and a choice of four colors of leather is extra. In the Windsor and New Yorker, two-tone broadcloth and neutral taupe broadcloth are standard and in addition a choice of four colors in leather and four combinations of Bedford cord and leather, all listing as extras. In the convertible coupes of these lines the choice of various colors of leather is standard. The Town and Country line offers Saran woven plastic and leather or Bedford cord and leather, all as standard.

There are 13 standard paint colors, as follows: Military blue, St. Clair blue, Newport blue, heather green, polo green, meadow green, dove gray, gunmetal gray, Catalina tan, black, and regal maroon, which are available on all models. Sumac red and palace brick brown may be had as standard on the convertible coupes and on the Town and Country line, respectively.

De Soto Body Types

Ten body types comprise the De Soto 1946 line. The three-passenger coupe, club coupe, two-door and four-door sedan are in the de luxe lines, while the

(*Turn to page* 70, *please*)

MAKE SMOOTH-RUNNING ENGINES

Cast Gunite crankshafts have inherent damping characteristics which greatly reduce the vibrations that develop at critical speeds in internal combustion engines. As a result, *engines with cast crankshafts will run smoothly over their full speed range.* Cast crankshafts offer almost unlimited freedom of design in the size and location of counterbalances. Our experience in producing crankshaft castings enables us to provide you with a qualified source for such parts. Examples of current production, shown above, include one for a small pleasure car, one for a washing machine, and one for a portable electric generator. Send us your present or projected data for suggestions and quotation.

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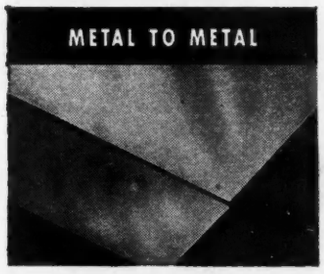
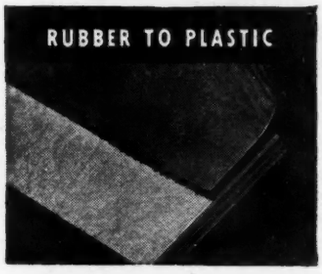
Manufacturing facilities for Pliobond are rapidly being increased to meet all demands. For sample and technical information, please use coupon, writing us in detail on any special problems.





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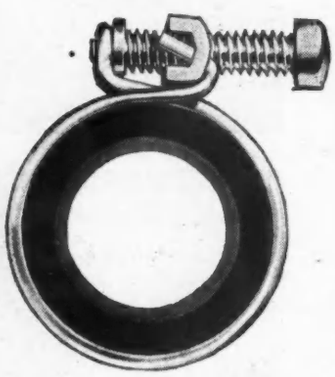

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custom line will include the club coupe, convertible coupe, brougham, four-door sedan, seven-passenger sdan and seven-passenger limousine. Ten colors and four two-tone combinations will be available.

De Soto's restyling is highlighted by a new front end. A die cast grille of wide chromplated vertical bars extends across the front of the car, fender and body side moldings are also chrome-plated. As in the Chrysler line, the wheels have been changed from 16 to 15 in. and 6.50-15 tires will be used.

The instrument panel has been restyled with grain finish in Flemish gray. Upholstery comes in a choice of pile fabrics or broadcloth. There is a new stoplight in the rear, which with tail lights, can be serviced from inside the luggage compartment without removing lenses. Tail lights also illuminate the inside of the luggage compartment.

Plymouth

A four-door sedan, two-door sedan, five-passenger club coupe, and business coupe are available in either the de luxe or special de luxe models. A convertible coupe and a station wagon complete the special de luxe line. The front end, fenders, moldings, and bumpers have been redesigned. The new Plymouths offer pile fabrics and, in the special de luxe, an additional choice of pencil stripe broadcloth in light shades. An interesting feature is the safety-signal speedometer which automatically indicates speed range through green, amber, and red lights. The green light illuminates the speedometer at speeds up to 30 mph, the amber illuminates between 30 and 50 mph, and the red light comes on for speeds over 50 mph.

Getting the Bear by the Tail

(*Continued from page* 15)

propositions as the ability-to-pay theory of wages. Recognition of the wider implications of such a principle requires a detachment of viewpoint and a familiarity with the practical operation of the competitive economy that most workers—and perhaps most other citizens—do not possess. There is an urgent need for more general comprehension of the fundamental fact that labor is one of several productive factors in a system where the share of each factor in the joint product is limited by the shares of the others. But this system is so richly productive that it already yields labor a far higher standard of living than has ever been produced in the past, and is capable of yielding immeasurable further gains in the future, provided it is left free to function in its normal way.—*From The Guaranty Survey published by Guaranty Trust Co. of New York.*

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